American Machinist

Established 1877 McGraw-Hill Publishing Company, Inc.

New York, June 18, 1931

From the day of the Damascus blade, little progress was made in cutting mediums until the Twentieth Century invention of high-speed steel

CUTTING MATERIALS Yesterday and Tomorrow

Periodic evolution rather than gradual development has characterized metal-working history. Where will the present transition lead?

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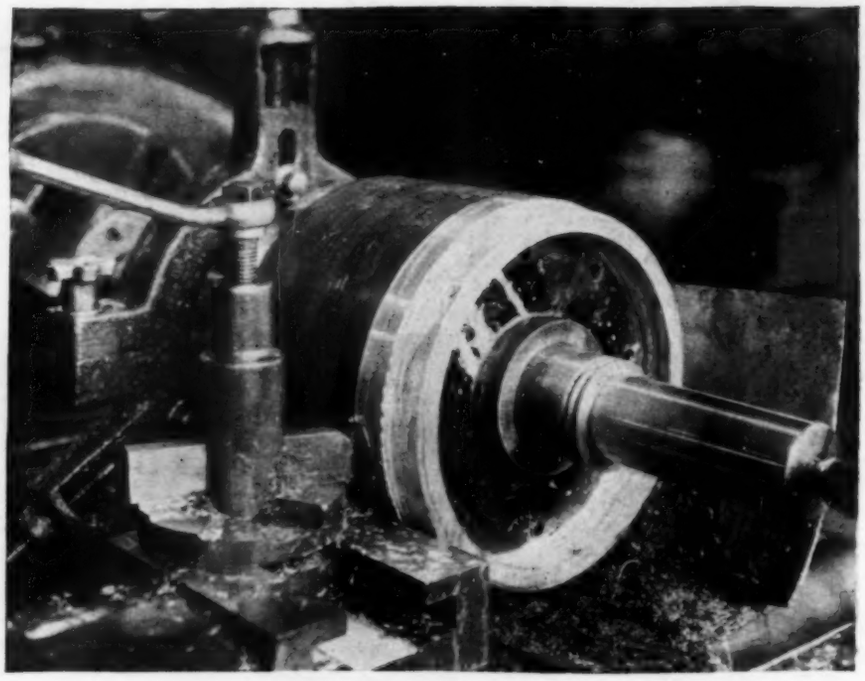
STEEL is considered the barometer of the American stock market. Its importance in this rôle is equal to that which it has played in the development of our present industrial system as well as in all phases of human endeavor. Corresponding in significance is the influence of the modern mechanisms which serve in the production of the myriads of articles required by man. The importance of new cutting metals and machinery that are designed to assist steel in becoming more essential, is of ever increasing concern.

Evidences of ancient forges and smelters indicate a knowledge of iron which dates back to the time of prehistoric man. The ancients in time were able to produce some serviceable steels by using pieces of meteoric iron followed by iron accidentally carbonized in a charcoal fire and given additional hardness by quench-

ing. Coincident with the advance of civilization came the development of steel. The famous Damascus and Toledo blades are well known for the prominent roles they played in history. It is said that Richard Coeur de Lion and the Saracen Emperor at a meeting in Palestine were bragging about their swords. Richard ordered a bar of steel about an inch square to be placed before him, whereat he brandished his favorite five-foot two-handed sword mightily over his head and neatly clipped the bar in two with one blow. The Saracen Emperor responded by ordering a lady's veil to be thrown into the air, and while it was floating on a light breeze, he drew his curved scimiter and deftly parted the filmy material.



Steel, as a means of cutting metal, played but a small part until the last part of the Eighteenth Century. Between the end of the Eighteenth and the beginning of the Twentieth Century, whatever progress occurred was to be found in the development of the machine tools in which the steels were used. But little progress was made in the excellence of cutting steels themselves, the century old method of treatment still being used. Soon machine tools had outstripped cutting metals by their ability to transmit more power to the cutting tool than the latter could stand. It was recognized that the transmitted energy is consumed partly in physically removing the chip and changing its form, partly in heating the work, and partly in heating the tool. The majority of this heat originates at the tip of the tool, which being continuously at work, has little chance to cool. This high local heat is roughly a direct function of the speed at which the metal is removed; hence, the temper limit of the cutting material limits the cutting speed. Carbon steels were thus found to be inadequate, and although some refinements such as Mushet steel were developed, the art of cutting metals received its real impetus only with the discovery of high-speed steel. Although potentially a highly superior cutting metal, high-speed steel required time for introduction. It was expensive; it was new. Taylor's recommended cutting tool angles and rakes were in variance with the bigoted practices of many operators. Faster speeds were not feasible because of the inadequacy of machine tools. Gears were stripped of their teeth and bearings ran hot. Awesome vibration, resulting from the higher speeds, was the source of justified trepidation on the part of the operator and usually prompted him to reduce his activities to the original pace.

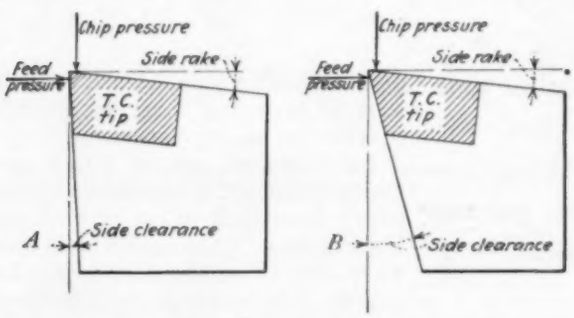


Fig. 1—Taylor's findings on tool rakes must be revised materially when tungsten carbide is used

An interesting book is Becker's "High-Speed Steel," written in 1910, giving information on how to apply the then new cutting metal; interesting, because today a very similar situation exists to that in which the author found himself regarding cutting tools and their use in machine tools, except that today, instead of high-speed steel, the new cutting material is cemented tungsten-carbide. Industries are rapidly becoming acquainted with this new material, but even yet, considerable confusion exists concerning the exact nature of it. In casual conversation with the shop mechanic, one hears it referred to as "that new steel." This is apparently incorrect. The correct conception of the nature of cemented tungsten-carbide is of fundamental importance both in applying it as a cutting material and in designing machine tools for its use.

The chief ingredient in cemented tungsten-carbide is tungsten. Pure tungsten is relatively ductile but is affected by carbon in much the same manner as iron. Tungsten-carbide is an extremely hard substance. In manufacturing cemented tungsten-carbide, pure tungsten is made to absorb all the carbon it possibly can hold. The resulting carbide is powdered and mixed with metallic cobalt, the percentage of cobalt being determined by the hardness desired in the cutting material. The mixture is made homogeneous by milling it in a ball mill, after which it is sifted through a very fine screen. The resulting powder is pressed into desired shapes under enormous pressure. In this condition, the tungsten-carbide plus the cobalt is very easily damaged, but after a preliminary firing in a hydrogen furnace, the masses can be handled conveniently and worked to any desired shape before they acquire their final hardness. The final firing occurs in a reducing atmosphere usually obtained with the presence of carbon. The hydrogen prevents oxidation, and the presence of carbon satiates the appetite of the hydrogen for carbon, thus preventing decarburization of the carbide.

Cemented tungsten-carbide, having about a six per

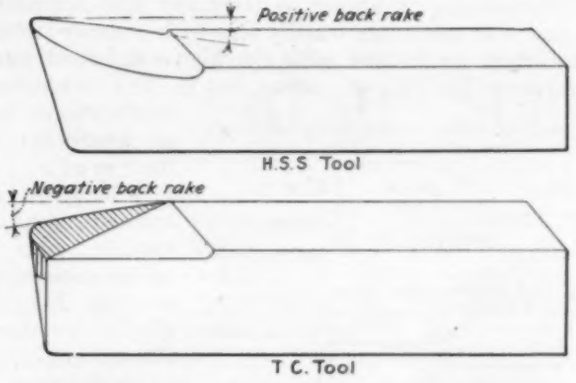


Fig. 2—Brittleness and weakness in shear influence grinding angles. A negative back rake is often desirable with a tungsten-carbide tip

cent cobalt bond after the final firing, is of sufficient hardness to scratch a sapphire. It consists of minute particles of tungsten-carbide cemented together with a bond composed essentially of cobalt, the hardness of the mixture varying inversely with the amount of cobalt present. The reason for using cobalt is that it is commercially the most adaptable high melting point metal that will not steal the carbon from the tungsten and thereby make itself a brittle carbide and a weak cementing material. Six per cent cemented tungsten-carbide gives a Rockwell reading of about 90 on the "C" scale, which in every day terms means that the material is very, very hard.

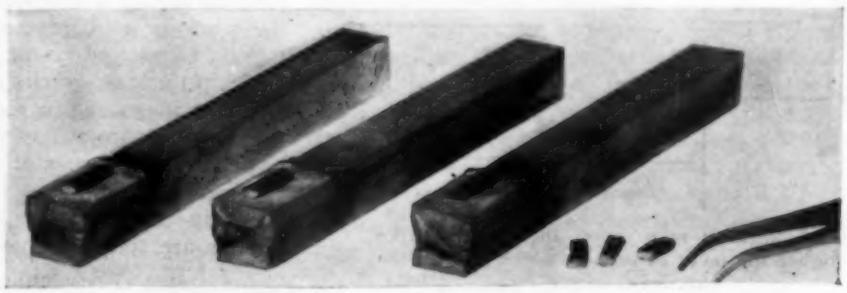
Cemented tungsten-carbide's chief virtues are its ability to withstand abrasion and its imperviousness to high temperatures. It also has the highest compressive strength of any known substance. Its major deficiencies are its brittleness, its low tensile strength, and its extreme capacity to resist any attempt to shape it. The ease with which the edge of a cemented tungsten-carbide tool chips under shock or vibration illustrates its brittleness, while the grinding difficulties illustrate its resistance to abrasion. Its shear and tensile strengths are low compared with the corresponding values obtained with high-speed steel. These characteristics must be kept in mind when tungsten carbide is used.

Cemented tungsten-carbide is usually applied as a tip to a supporting member, as small a piece being used as is consistent with satisfactory and economic results. For cutting tools, the smaller the tip, the less the first cost of the tool. However, cost is really a secondary factor, and the use of small pieces of cemented tungsten-carbide, with less expensive metal as a support, is a result of the weakness of the material, which precludes the possibility of constructing the cutting tool of it entirely. The prime purpose of the shank is to give support to the tip. Individuals, who wish to economize by using small tips are defeating their own purpose, since a larger tip is usually more economical. With the larger tips, the joint or braze is more removed from the cutting elge and therefore cooler. Assuming equal strength in shanks, the heavier tip will give the stronger tool.

Shanks are normally larger than corresponding high-speed steel tools for several reasons. Angles on cemented tungsten-carbide tools are less acute and result in greater pressure at the tool tip. Deflections with cemented tungsten-carbide tools, because of the nature of the cutting material, should be even less than with high-speed steel. Because of the higher speeds, any vibration is augmented, while the heat generated at the tip will be considerably increased. The insertion of the tip appreciably weakens a shank of normal cross section. Compensation for these factors is obtained by increasing the cross section of the shank. The proportions of the backing for cemented tungsten-carbide, whether in the form of a tool shank or any one of the many other applications, should in all cases be as generous as feasible. That is the first fundamental in the application of this new cutting material. Inadequate backing will invariably result in failure. Nickel steel serves very well as a shank, having good strength and being free of elements which render brazing difficult, if not impossible. The heat processes do not cause this material to chip or split. Nickel steel has the undesirable feature of a high coefficient of expansion compared with that of cemented tungsten-carbide.

The methods of attaching cemented tungsten-carbide vary somewhat; the general idea, however, is the same. In the ordinary lathe tool, for example, a popular method is to mill a slot in the corner of the shank and to fit the tip to the slot. The tip is quite firmly attached to the shank by copper brazing in a non-oxidizing atmosphere. The braze furnishes a thin cushion of copper between the cemented tungsten-carbide and its support, and to some extent, permits the dissimilar metals of the tip and backing to expand and contract much as they please while passing through the various necessary temperature ranges. It is important that the correct amount of copper be used. With too much copper, there is considerable danger of non-uniform support to the tip caused by localized softening of the copper which may be induced by the high temperatures involved in a cutting operation. The result is bending and a broken tip. However, after a little experience effective brazes may be made without real difficulty.

It is interesting to note that cemented tungsten-carbide has a coefficient of expansion about one-half of that of Invar steel, which has virtually a constant length for average temperature changes. Welding the tip to the shank is undesirable because of the difference in the coefficient of expansion of the cemented tungsten-carbide and the shank material and the fact that a normalizing



Tungsten carbide finds its widest use as brazed tips. Too small a tip is poor economy because of the proximity of the braze to the heat of machining

process will not relieve the strain set up after the tool has cooled. The welded tool may even pass inspection and be placed in the storeroom, but when removed a month or so later, cracks may already be evident or appear shortly after the tool is applied in service. Other methods, such as casting the tip in the shank, spot welding, and similar attempts have been made but with little success. Methods of wedging the tip in the supporting shank have been developed, but the braze still remains as the general method of attaching the material.

With normal feed, but very much increased speed, tremendous pressures and enormous amounts of heat are generated at the tool tip. It is not an unusual sight to see a cemented tungsten-carbide tool cutting steel with the tip at a bright red heat. Under these conditions, tool failure may result from the melting of the copper and the accompanying removal of support for the tip. It has been said that the heavier feeds are not desirable with cemented tungsten-carbide because of its inherent weakness and the high tool pressures involved, and that the copper braze was therefore equal to any service the cemented tungsten-carbide tip might withstand. Nevertheless, machine tool refinements, permitting greater tool pressures as a result of increased rigidity and decreased vibration, will soon transfer the issue to the copper braze and cause it to be the limiting feature.

Probably no greater variance exists in any other field of endeavor than in the art of metal cutting and its subject of tool angles. Each mechanic has his favorite grinds, every foreman his theories, every shop its own practices. Taylor's contribution to the use of high-speed steel, although essential in the use of that metal, is inapplicable to cemented tungsten-carbide tools when details are considered. The similarity between the fundamentals of the two practices is readily apparent, however. In fact, in many fundamental statements concerning high-speed steel, the words "high-speed steel" could be replaced by "cemented tungsten-carbide" without detracting from the truth of the statement. Every application of cemented tungsten-carbide is a study in itself but fundamentals are applicable to all cases. A few of these will be briefly reviewed. Tips should be large enough adequately to take care of the cut, to permit grinding, and to remove the joint from the point of high local heat.

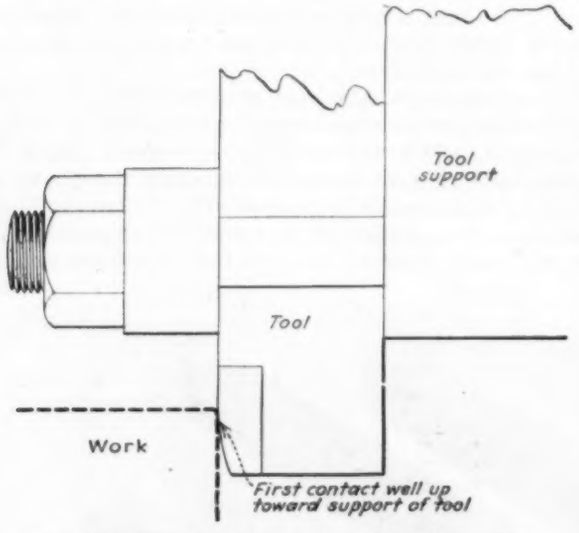


Fig. 3—A negative rake causes the tool to strike well toward the point of support which reduces the effective overhang

The various angles, known as front and side clearances, top and side rakes, are usually less with cemented tungsten-carbide tools than with the high-speed-steel tools. The reason for this, of course, lies in the characteristic brittleness or lack of toughness of the material. Overhang in cemented tungsten-carbide tools is to be avoided, as also are sharp angles. A simple illustration of this point is given in Fig. 1. *A* possesses a greater cross section in the direction of the indicated force than *B*, whose excessive clearance produces a cutting edge less able to withstand shearing forces by virtue of the reduced cross section and absence of support.

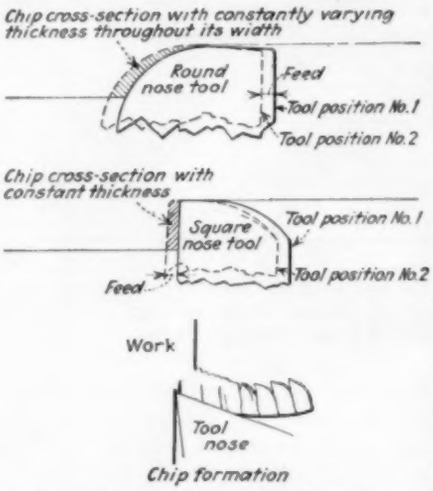


Fig. 4—A curved cutting edge gives a varying chip thickness which minimizes the likelihood of chatter

Usually comparative side views of high-speed steel and cemented tungsten-carbide general purpose tools differ considerably as shown in Fig. 2. The negative rake illustrated in Fig. 2 is another means of strengthening the tip. It assists the shearing action by having a sloping cutting edge and contributes to the protection of the tool by causing the initial force of a newly started cut to strike well up toward the shank. An illustration of this point is given in Fig. 3, which may represent a tool in an intermittent cut, or a planer tool beginning a cutting stroke.

Sharp corners on tools are to be avoided because of their susceptibility to chipping and inability to withstand shearing forces. Round noses not only are stronger but possess the property of advantageously forming the chip. Chips consist of sheared sections in echelon formation, the line of demarcation being quite prominent in the heavier feeds with slower speeds. Each time shearing takes place, an appreciable shock occurs caused by the sudden decrease and rebuilding of the pressure on the tool. The number of sheared sections per inch of chip varies with the feed or thickness of the chip, and because of the shearing process vibration also varies with the thickness of the chip. Each thickness of chip has its own period of vibration. If the chip is uniform in thickness, it is evident that the pressure peak will arrive simultaneously at all points along the cutting edge and will be followed an instant later by a corresponding period of low pressure. If the frequency of the pressure variations corresponds to the natural frequency of the work or tool, severe chatter with consequent deleterious effect will result. With a curved cutting edge, the chip thickness varies constantly throughout its entire width as illustrated in Fig. 4. At no one period of time can the pressure at any point of the curved edge be the same as it is at any other point. Therefore, no fixed frequency of impulses resulting from the shearing of the chip can exist, and vibration of the tool tip and chatter are thus eliminated.

A concluding article on this subject will appear next week.

ACME SCREW THREADS

While commending the work of the National Screw Thread Commission and indorsing its standards, this author presents auxiliary data and proposes certain refinements to render the Commission's report of greater value

WILLIAM WHITNEY

TABLE 1 – ACME SCREWS		Page
Standard sizes and pitches	= See table, T77 Page 152	152
Basic angle	= 29 deg. axial plane	150
Basic major D.	= Nom. major D.	
Basic pitch, D.	= Basic major D. -0.5 P.	
Basic minor D.	= Basic major D. -P.	
Basic tool or bottom flat	= 0.37069 P.	151
Basic working depth	= 0.5 P.	151
Basic tooth thickness at basic P.D.	= 0.5 P.	150
Basic tooth addendum	= 0.25 P.	151
Basic tooth dedendum	= 0.25 P.	
N.S.T.C. Std. Acme, Mx. Hel. at Mr. D.	= 5 deg. approx.	152
Class I		
Mx. Mj. D.	= Basic Mj. D.	153 i
Mn. Mj. D.	= Basic Mj. D. -0.5 P.	153 h & 157
P.D. Clear or Bas. P.D. -Mx. P.D.	= 0.020 VP. on D.	154 ft. note
Mx. P.D.	= Basic P.D. -0.020 VP.	153 b
Mn. P.D. Exact = Mx. P.D. - 3.866717 (0.001 √Bas. Mj. D. + 0.005 VP. + 0.001 x L'gth Eng't.)		fr. thick. tol.
Mn. P.D. Approx. = Mx. P.D. - 3.866717 (Col. 4 Pg. 157, T78 + Col. 2 Pg. 157, T79)		155
Mr. D. Clear or Bas. Mr. D. - Mx. Mr. D.	= 0.020 VP. on D.	153 b, 150
Mx. Mr. D.	= Basic Mr. D. -0.020 VP.	153 b
Mn. Mr. D.	= Mn. P.D. -0.5 P. for 0.3707 P. tool flat	153 l
Mx. Mr. D. tool or bottom flat	= 0.3707 P. +0.0000 -0.0005 } No authority for limits.	154
Mn. Mr. D. tool or bottom flat	= 0.3707 P. +0.0005 -0.0000 } To keep within Mr. D. Tol.	154
Tooth thickness clearance	= 0.005 VP. See T78, Col. 3	157
Mx. Tooth thickness	= 0.5 P. - 0.005 VP.	153 b
Mn. Tooth thickness	= Mx. tooth thick. - exact tooth thickness Tol.	153 al
Exact tooth thickness Tol.	= 0.001 √Bas. Mj. D. + 0.005 VP. + 0.001 x L'gth. Eng't.	154 c
Mean value of 0.001 √Bas. Mj. D. + 0.005 VP. for pitches Pg. 152 and within Mj. D. range from 1 to 3 times Col. 4 Pg. 152	= 0.005 VP. - 0.001 (1 + √3) √Col. 4 Pg. 152, T77 = Col. 4 Pg. 157, T78	155
Approx. tooth thick. Tol. at mean value	= Col. 4 Pg. 157, T78 + Col. 2 Pg. 157, T79	155
Class II		
Mx. Mj. D.	= Basic Mj. D.	153 i
Mn. Mj. D.	= Basic Mj. D. -0.05 P.	153 h & 161
P.D. Clear or Bas. P.D. -Mx. P.D.	= 0.005 VP. on D.	158 ft. note
Mx. P.D.	= Basic P.D. -0.005 VP.	158 b
Mn. P.D. Exact = Mx. P.D. - 3.866717 (0.001 √Bas. Mj. D. + 0.005 VP. + 0.0005 x L'gth Eng't.)		fr. thick. tol.
Mn. P.D. Approx. = Mx. P.D. - 3.866717 (Col. 4 Pg. 161, T80 + Col. 2 Pg. 161, T81)		159
Mr. D. Clear or Bas. Mr. D. - Mx. Mr. D.	= 0.005 VP. on diam.	158 ft. note
Mx. Mr. D.	= Basic Mr. D. -0.005 VP.	157 b
Mn. Mr. D.	= Mn. P.D. -0.5 P. for 0.3707 P. tool flat	153 l
Mx. Mr. D. tool or bottom flat	= 0.3707 P. +0.0000 -0.0005 } No authority for limits	158
Mn. Mr. D. tool or bottom flat	= 0.3707 P. +0.0005 -0.0000 } To keep within Mr. D. Tol.	158
Tooth thickness clearance	= 0.00125 VP. See T80, Col. 3	161
Mx. Tooth thickness	= 0.5 P. -0.00125 VP.	158
Mn. Tooth thickness	= Mx. tooth thick. exact tooth thick. Tol.	153 a
Exact tooth thickness Tol.	= 0.001 √Bas. Mj. D. + 0.005 VP. + 0.0005 x L'gth. Eng't.	158
Mean value of 0.001 √Bas. Mj. D. + 0.005 VP. for pitches Pg. 152 and within Mj. D. range from 1 to 3 times Col. 4 Pg. 152	= 0.005 VP. + 0.001 (1 + √3) √Col. 4 Pg. 152, T77 = Col. 4 Pg. 161, T80	159
Approx. tooth thick. Tol. at mean value	= Col. 4 Pg. 161, T80 + Col. 2 Pg. 161, T81	159
Class III		
Same as Class II		161 b
Lead error = ± 0.002 in 1 to 12" of nut travel. Nut L'gth. Apx. same as will be used		162
Class IV		
Same as Class II		162
Lead error = ± 0.001 in 1 to 12" of nut travel. Nut L'gth. Apx. same as will be used		162

THE Report of the National Screw Thread Commission—revised 1928 with corrections to June 15, 1929—is a splendid piece of work. However, I have several suggestions for modification which would greatly enhance its value to the man in the shop and facilitate its wider adoption in industry. For example, the report covers Acme screws and nuts mixed throughout. It gives general specifications and adaptability of classes in a way which makes it cumbersome as a reference for production purposes. The report must be studied to be understood; a pre-knowledge of the subject is necessary to find its practical application.

To illustrate: let the reader find the maximum and minimum major, pitch, and minor diameters; also the maximum and minimum tooth thickness for a 1½ in.—4 pitch, single Acme screw, Class II fit, for a nut 4 inches long. The report does not recommend the shop's working to the pitch diameter; but the pitch diameter is required to determine the minimum minor diameter especially for ground thread screws. It is needed for checking purposes in the production of a uniform product because measurements relying upon tooth thickness alone leave much to be desired as compared with wire measurements.

Again, one of the most misunderstood and confusing terms, "Allowance," should be cleared up. Allowance is used and defined on page 17 when referring to clearances and interferences in general. All classes of Acme threads have clearance only. So when reference is made to a specific class, only the word, "Clearance," should be used. The mixing of the words "Allowance" and "Clearance" causes much confusion. For instance on page 150, a subtitle reads, "Clearance at minor diameter." On the adjacent page 151 in the sectional view at the lower right-hand corner, this same clearance is labeled "Allowance," on the minor diameter. My point is that each word, such as "Allowance," "Clearance," "Interference," and "Limit," should have one meaning. This would help the shop and spread standard practice more rapidly. The word "Allowance" could well be dropped as a reference to clearance for it is already extensively used in the shop in the sense of a sharpening allowance or the amount that may be ground from the flute of a worm hob or tap, which is relieved, before the tool becomes undersize. Having adopted the definitions on page 150, subtitles 4 and 5, I found it helpful to stick to the word clearance. Accordingly, in my copy of the report, I changed "Allowance" to "Clearance" in 25 places on pages 151 to 162 inclusive.

TABLE 2 — DATA FOR ACME SCREW FORMULAS

1		2	3	4	5	6	7	8	9
Recommended Major Diam. for given T.P.I.		Col.-2 Pg-157 T-78 / Col.-2 Pg-161 T-80			Col.-4 Pg-152 T-77	Col.-3 Pg-161 T-80	Col. 3 Pg-157 T-78		For Col.4 Pg-157 T-78 / For Col.4 Pg-161 T-80
Maj. Diam.	T.P.I.	Pitch	0.5P	0.05P	0.37069P	$0.00125\sqrt{P}$	$0.009\sqrt{P}$	$0.020\sqrt{P}$	Range of Bas. Major Diam's. for T.P.I. in Col. 1
4½	1	1.00000	0.50000	0.05000	0.37069	0.00125	0.00500	0.02000	4½ to 13½
3½	1⅓	0.75000	0.37500	0.37500	0.27802	0.00108	0.00433	0.01732	3½ " 10½
3	1½	0.66667	0.33333	0.33333	0.24713	0.00102	0.00408	0.01633	3 " 9
2¼	2	0.50000	0.25000	0.02500	0.18535	0.00084	0.00354	0.01414	2¼ " 6¾
1¾	2½	0.40000	0.20000	0.02000	0.14828	0.00079	0.00316	0.01265	1¾ " 5¼
1⅝	2⅔	0.37500	0.18750	0.01875	0.13901	0.00077	0.00306	0.01225	1⅝ " 4⅜
1½	3	0.33333	0.16667	0.01667	0.12356	0.00072	0.00289	0.01155	1½ " 4½
1⅛	4	0.25000	0.12500	0.01250	0.09267	0.00063	0.00250	0.01000	1⅛ " 3⅜
⅞	5	0.20000	0.10000	0.01000	0.07414	0.00056	0.00224	0.00894	⅞ " 2⅝
¾	6	0.16667	0.08333	0.00833	0.06178	0.00051	0.00204	0.00816	¾ " 2¼
5/8	7	0.14286	0.07143	0.00714	0.05296	0.00047	0.00189	0.00756	5/8 " 1⅞
9/16	8	0.12500	0.06250	0.00625	0.04634	0.00044	0.00177	0.00707	9/16 " 1 11/16
½	9	0.11111	0.05556	0.00556	0.04119	0.00042	0.00167	0.00667	½ " 1½
7/16	10	0.10000	0.05000	0.00500	0.03707	0.00040	0.00158	0.00632	7/16 " 1 5/16
3/8	12	0.08333	0.04167	0.00417	0.03089	0.00036	0.00144	0.00577	3/8 " 1⅛

10	11	12
Bas. Maj. Diam.	$0.0004\sqrt{\text{Bas. Maj. Diam.}}$	$0.001\sqrt{\text{Bas. Maj. Diam.}}$
5/8	0.00085	0.00061
7/16	0.00092	0.00066
½	0.00099	0.00071
9/16	0.00105	0.00075
5/8	0.00111	0.00079
¾	0.00122	0.00087
⅞	0.00132	0.00094
1	0.00140	0.00100
1⅛	0.00148	0.00106
1¼	0.00157	0.00112
1⅜	0.00164	0.00117
1½	0.00172	0.00123
1⅝	0.00179	0.00128
1¾	0.00185	0.00132
1⅞	0.00192	0.00137
2	0.00197	0.00141
2¼	0.00210	0.00150
3	0.00242	0.00173

13	14	15
	Col.-2 Pg-161 T-81	Col.-2 Pg-157 T-79
Length of Engagement	0.0005 x Length of Engagement	0.001 x Length of Engagement
½	0.00025	0.00050
¾	0.00038	0.00075
1	0.00050	0.00100
1½	0.00075	0.00150
2	0.00100	0.00200
2½	0.00125	0.00250
3	0.00150	0.00300
3½	0.00175	0.00350
4	0.00200	0.00400
4½	0.00225	0.00450
5	0.00250	0.00500
5½	0.00275	0.00550
6	0.00300	0.00600
6½	0.00325	0.00650
7	0.00350	0.00700
8	0.00400	0.00800
10	0.00500	0.01000
12	0.00600	0.01200

The Value of $\frac{0.001(1+\sqrt{3})}{2}$ in formulas = 0.0014

* Col. 4 Pg 157, T 78 } = $0.005\sqrt{P} + 0.0014\sqrt{\text{Bas. Maj. Diam.}}$

* Col. 4 Pg 161, T 80 }

To facilitate the use of the report, I have prepared Table 1 giving the basic formulas and Class I, II, III, and IV formulas and Table 2 giving data for solving these formulas. The page numbers in the last column of the table, refer to the Commission's report. Let us apply this material to the example given above—1½-in., 4 pitch Acme screw for a 4-in. long nut, made to a Class II fit. The data are taken as they would most likely be needed.

The base or nominal major diameter	=	1.5000
Maximum major diameter	=	1.5000
Minimum major diameter	= 1.5000–0.0125	= 1.4875
Basic pitch diameter	=	1.3750
Maximum pitch diameter	= 1.3750–0.0025	= 1.3725
Minimum pitch diameter, exact	= 1.3725–0.0221	= 1.3504

There seems to be no reason why the exact minimum pitch diameter should not be used as it is simple to find, but the approximate minimum pitch diameter may be found if desired from the tables.

Minimum pitch diameter, approximate	= 1.3750–0.0241	= 1.3509
Maximum minor diameter	= 1.2500 (basic)–0.0025	= 1.2475
Minimum minor diameter	= 1.3504–0.1250	= 1.2254
Maximum tooth thickness	= 0.1250–0.0006	= 0.1244
Exact tooth thickness, tolerance		= 0.0057
Minimum tooth thickness	= 0.1244–0.0057	= 0.1187

Here again, the exact minimum tooth thickness is simpler than the approximate value, which only confuses the standard. However, the approximate value is given taken from the tables with only simple operations to perform.

Approximate tooth thickness tolerance	= 0.0062
Approximate minimum tooth thickness	= 0.1244–0.0062 = 0.1182
Basic tool flat	= 0.09267

Tool flat for the mean pitch diameter and the mean minor diameter = 0.09267 ± 0.002 for the mean minor diameter of 1.2365 (The tolerance ± 0.002 is mine)

Tool flat for the maximum minor diameter	$= 0.09267 \pm {}^{0}_{0.0005}$
Tool flat for the minimum minor diameter	$= 0.09267 \pm {}^{0.0005}_{0}$

The National Screw Thread Commission standard allows no tolerance on bottom flats, but to keep within the minor diameter limits adpoted, I have added the above tolerance. The only advantage in working to the mean pitch and minor diameter lies in the ±0.002 tool flat. But with present-day manufacturing tools the 0.0005 tolerance on the tool flat can be held very closely by working to wire measurements for the pitch diameter and to the depth from the major diameter. Thus the bottom flat would be theoretically correct within the limits regardless of the more or less worn corners. To hold to 0.0005 on the tool flat is easy enough for ground threads, but this tolerance would surely have to be increased for commercial threads. Unfortunately the National Screw Thread Commission report does not enlighten us on bottom flat limits whereas I believe this should have been the starting point, inasmuch as the screw and nut are to have practically a bearing at the minor diameters.

The tables include suggested abbreviations, a subject which has not been given due consideration. For in-

stance five words beginning with *M* are commonly used for threads: maximum, minimum, major, minor, and mean. It is hard to abbreviate these terms on shop prints—"min." may mean minimum or minor. It is logical to retain O.D., P.D. and R.D. for outside, pitch, and root diameters respectively. The abbreviations, given mx. for maximum, mn. for minimum, mj. for major, and with mean spelled out hold well in the shop. Mr. for minor can never be confused with mister, when it is used as a thread term. Brevity and clearness mean much in a progressive shop in formulas and in tabulations.

A brief explanation regarding Table 2 may be of help. The mean minor diameter as formulated by the National Screw Thread Commission is based upon a helix angle of approximately five degrees at the minor diameter. This limits the range of diameters which may be used with a certain pitch to from one to three times the diameter listed on Page 152 Column 4. See page 155 (d) or refer to the tabulated list on Table 2 column 9. The first step is to see if the desired pitch and diameter are within this range. If so, the constants on the data sheet may be used; if not, the exact pitch diameter and tooth thickness tolerance should be figured and reference made to the data sheet. The term

$$\frac{0.001\ (1 + \sqrt{3})}{2}$$

in the formula is placed there to conform to the National Screw Thread Commission report, but the computed value is given on Table 2.

As stated before, the report is confusing to many. It is without system for answering questions asked by the shop and without sufficient cross references from page to page. One example should suffice to prove this. On page 152 Column 4, the head is "Recommended Minimum Major Diameter." Without study of the report and a knowledge of the standard, this column can easily be taken by the shop man to mean the minimum outside diameter; this infers that the maximum diameter would be larger. On the contrary, the sizes tabulated are maximum diameters. (See page 153, paragraph i). The title of this column might be "Smallest Major Diameter Recommended for a Given Pitch." The word minimum here is confusing. I believe this one example justifies my criticism.

Table 1 needs no explanation as to use since references are made to the National Screw Thread Commission Report with page numbers so the proper constants may be readily seen from the table. The first column of Table 2 lists diameters and corresponding pitches which are recommended as a basis for the final standard on Acme screws. Diameter and pitch do not appear as such side by side in the National Screw Thread Commission Report.

The Class I and Class II formulas are rewritten below with references to the data sheet instead of to the National Screw Thread Commission Report:

Table 3—Acme Screws

CLASS I	
Mx. Mj. D.	= Basic Mj. D.
Mn. Mj. D.	= Basic Mj. D. — Col. 4
Mx P. D.	= Basic P. D. — Col. 8
Mn. P. D. (exact)	= Mx. P. D. — 3.866717 (Col. 12 + Col. 7 + Col. 15)
Mx. Mr. D.	= Basic Mr. D. — Col. 8
Mn. Mr. D.	= Mn. P. D. — Col. 3
Tool flat	= Col. 5
Mx. tooth thick.	= Col. 3 — Col. 7
Mn. tooth thick	= Mn. tooth thick. — (Col. 12 + Col. 7 + Col. 15)
CLASS II	
Mx. Mj. D.	= Basic Mj. D.
Mn. Mj. D.	= Basic Mj. D. — Col. 4
Mx. P. D.	= Basic P. D. — Col. 7
Mn. P. D. (exact)	= Mx. P. D. — 3.866717 (Col. 12 + Col. 7 + Col. 14)
Mx. Mr. D.	= Basic Mr. D. — Col. 7
Mn. Mr. D.	= Mn. P. D. — Col. 3
Tool flat	= Col. 5
Mx. tooth thick.	= Col. 3 — Col. 6
Mn. tooth thick.	= Mx. tooth thick. — (Col. 12 + Col. 7 + Col. 14)

These data were used in obtaining the results for the example given. Thus two methods of obtaining screw thread limits are presented: one by using Table 1 in conjunction with the National Screw Thread Commission Report; and the other by using Table 2 with Table 3. The simplicity of using these tables in comparison with the Commission's Report alone is obvious. The next revision of this report might well include some such means to facilitate the use of these standards. This applies to other thread forms as well as Acme.

■

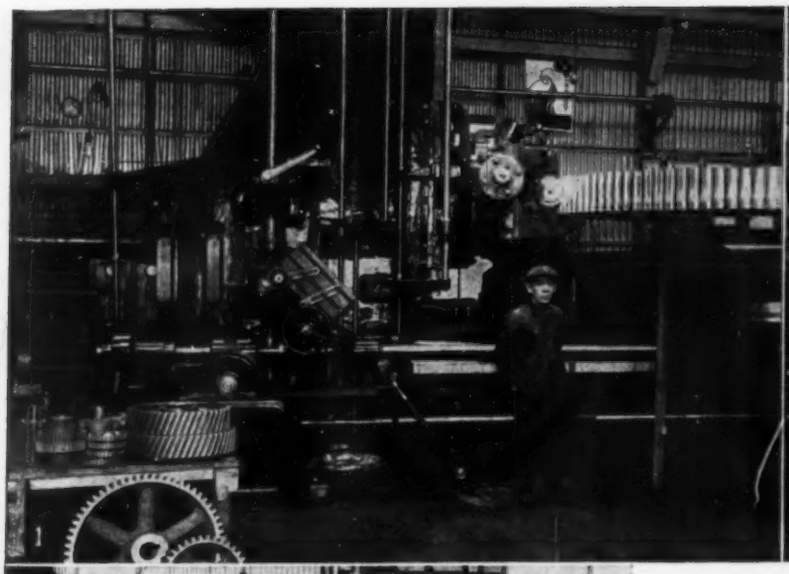
Bearings and Their Lubrication
Discussion

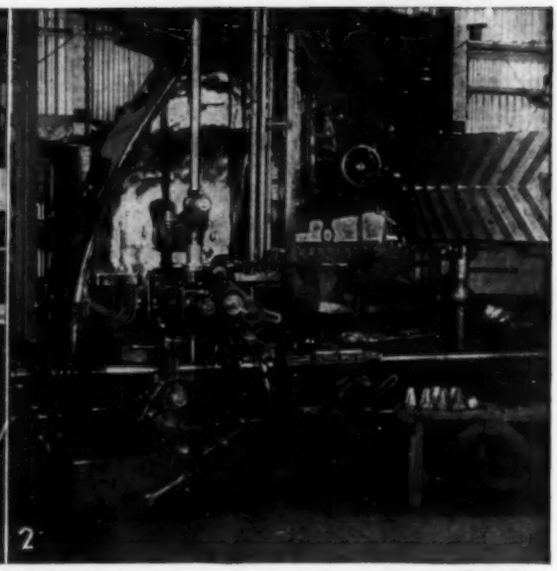
W. R. NEEDHAM
Engineer Design Department, English Electric Co., Ltd.

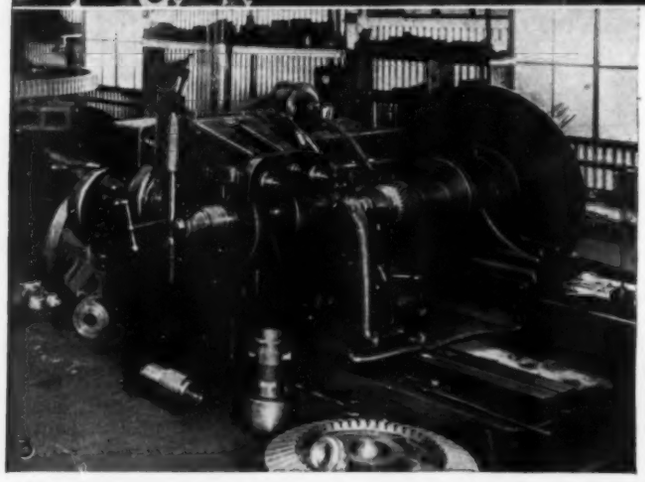
SEVERAL points from L. H. Nielson's address, referred to on page 198, Vol. 74, of the *American Machinist*, deserve careful attention from engineers. Despite the advance in modern knowledge, it is surprising how hard old prejudices die. Even yet, it is far from uncommon to find a deep oil groove at or near the position of maximum pressure. A little reflection should suffice to satisfy today's engineers that grooves anywhere in that region simply defeat the objective aimed at. Indeed, they do far worse than that, they tend toward a drastic impoverishing of the oil supply by largely choking it at the source. This in turn results in an even more vicious effect, for the film, which is essentially to fluid lubrication, is sustained, if at all, with extreme difficulty. This condition should be warded against wherever resultant maximum pressure may happen to be when an angular pull is applied.

Another fact which experiment and experience has established is that the oil-film bearing arc generally subtends an angle well under 90 deg. Accordingly, if such grooves are introduced, they should be not less than 90 deg. apart. They would then correspond roughly with the "on" and "off" edges of the equivalent bearing pad. It is now known that the reason why ordinary journal bearings function so surprisingly well is because of their accidental but extremely useful working resemblance to the true tilting pad, as perfected in practice by Kingsbury and Michell.

In many turbo and other high speed bearings, it is customary to rely upon two axial chamfer grooves one at each lower horizontal joint, and possibly two end grooves, one at either end of the bearing. The oil is fed into the "in" groove and spreads then over the pressure surface. Mr. Nielson was quite right in emphasizing the ill effects which often attend the provision of an elaborate network of grooves, particularly within the region of the film-bearing arc.







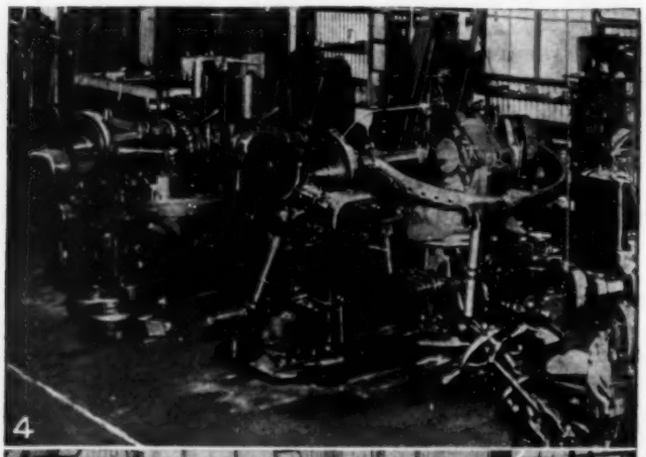
[1] Mr. Mizoguchi beside his 200-in. Karatsu hobber

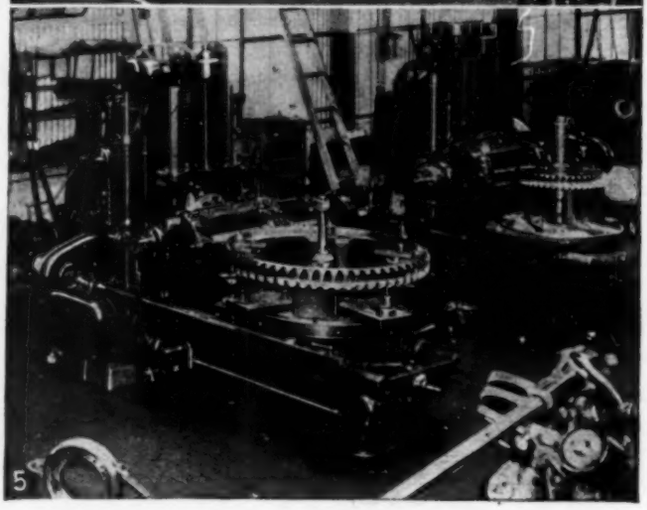
[2] Cutting a helical gear on a 150-in. Karatsu hobber

[3] A Sykes machine cutting a herringbone pinion

[4] Gleason machines for bevel gears

[5] German gear hobbers



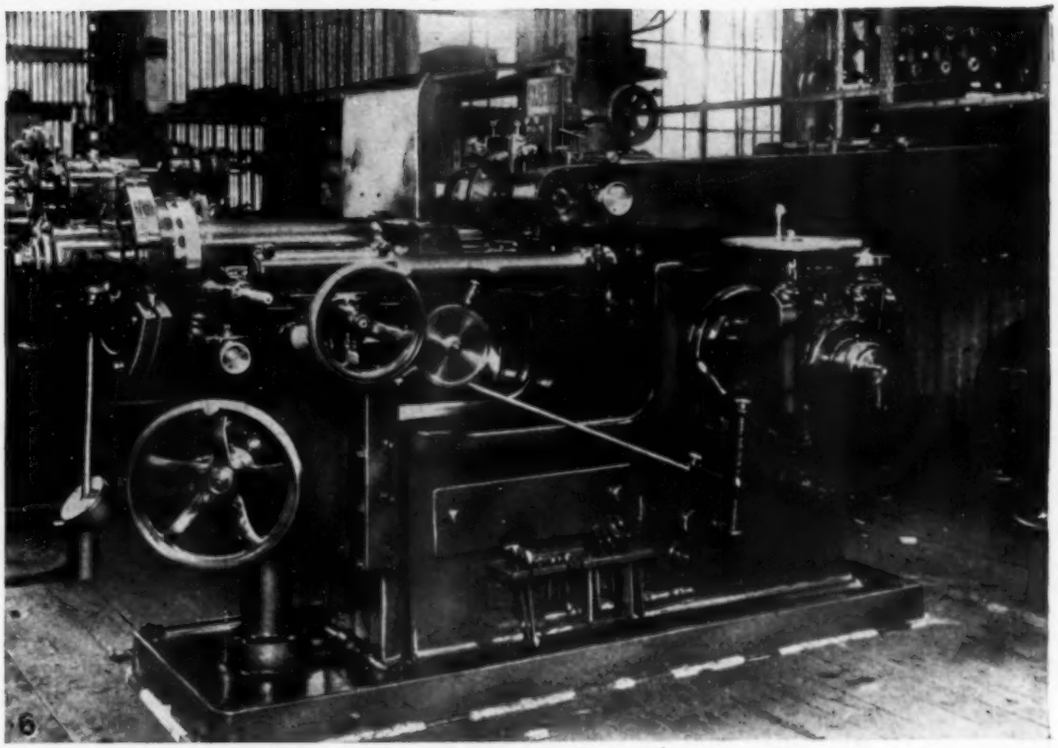


A Japanese Plant

with International Equipment

ABILITY and perseverance count no matter where they crop up. Something over 20 years ago a Japanese mechanic of Osaka felt the urge for better gear cutting, but capital was limited: two lathes and a milling machine were his entire equipment at the start. About a year ago he moved from his original little shop to the much larger new one, and the Mizoguchi Gear Works is now known from one end of Japan to the other. Mr. Mizoguchi, who still keeps in close personal contact with the work, has just purchased a 200-in. gear hobber made by the Karatsu Iron Works and weighing 55 tons.

The equipment is international, including machines from Pfauter, Reinecker and Schuchardt, of Germany; Muir and Brown, of England; Brown & Sharpe, Fellows, Flather, Gleason, Kearney & Trecker, Lodge & Shipley, Oesterlein, and Sykes of the United States. There are also numerous machines built by Karatsu, Sonoike, Okuma, Okamoto, Ikegai, and Niigata, in Japan.



[6] New special gear grinder by Okamoto, Japan, carries two wheels, each driven by belt from a single motor

[7] New shop of Mizoguchi Gear Works

[8] General view in shop showing large and small cranes, line shafting, track in center and variety of work handled

EXECUTIVE FORUM

One Line or Many?

WITH THE exception of the president, no one knew why the meeting of executives had been called. But Donald M. Graham, head of the Viking Tool Company, soon explained.

"I'm not one who holds that conferences can solve all business problems, but if they produce an occasional constructive idea, they're worth the time and effort. In common with most companies, our greatest concern at present is sales. We've all seen national, state and local 'Boost Business' meetings. Let's consider this our own private 'Boost Business' meeting. In the final analysis, the question of stimulating sales can be solved only by the efforts of individual companies. I want your suggestions as to what definite steps we should take to increase our volume of business."

"As sales manager, I am more directly interested in this problem than anyone else," said Frank Wallace. "My proposal is this. We now make a line of lathes, and for this product, I believe our sales are all that may reasonably be expected under present conditions. Our real need is something more to sell. A complete line of machine tools should be our ultimate goal, but we can't expect to achieve that end in one jump. However, we should start to augment our line without delay. To start the discussion, I suggest we go into the manufacture of milling machines and vertical drills. But I'd like to hear what some of the others have to say as to the details of the plan."

Allan Newton, the Chief Engineer, was next on his feet. "I have nothing to say about the details, but rather on the principle of the proposed move. We can design a milling machine, a drilling machine, and many other machine tools, but there's absolutely no economic justification for more manufacturers in those fields. We're known for our lathes, and our success in this line has come largely through our policy of concentration. When a man or a company has too many irons in the fire, some of them will suffer. I'd far rather see us lead the field with one particular type of machine than to scatter our talents over a large line of mediocre product. We might get greater sales volume with more machines to sell. But would the added sales be profitable?"

"At present all our eggs are in one basket," said Wallace. "The argument that we should stick to our single line because of tradition is unconvincing, to say the least. The inference that the engineering department cannot keep a wider range of machines up to date is an admission of weakness. I can say, that for the sales department, it is a decided advantage to have more irons in the fire. Sales in one type of machine lead to sales in another. We quote prices on lathes to many concerns that are in the market for other tools. Many of them would be glad to buy all their equipment from one manufacturer if they could."

"That was true a few years ago," said Graham, "but my impression is that buyers today are more likely to pick and choose. Many manufacturers have adopted a policy of simplifying the product instead of diversifying it."

"From a manufacturing angle," said Charles Griffin, the Works Manager, "the simpler our product, the greater the economy. I'm just as interested as Wallace in keeping this plant busy, but I'd dislike to see us take any action that would increase costs. I don't believe the sales department would like to have our prices go up either. What could we do with our new lines when business booms? Sometimes we have all we can do to fill orders on lathes."

"We don't have to worry about too many orders now," said Wallace. "When that becomes necessary, we can grow to meet the increased demand. A business can't stand still for long—it must move either forward or backward. If we continue to follow a stand-pat policy, we face a further retrogression."

Suggested by James R. Cornelius
Coventry, England.

■

What Do You Think About This Problem?

Greater diversification of product is often used by manufacturers in their efforts to stimulate sales. Others have taken a directly opposite course and have concentrated their efforts along their more profitable lines. Under present conditions, which program has the greater chance of success? Are sales and manufacturing interests opposed on this question?

. . . Discussion

of Executive Problems

■

Why Conventions?

Too many conventions have degenerated into mere pleasure trips or worse. A short time ago, I attended a convention and as soon as I entered the lobby of the hotel which was used for headquarters two men seized me and hurried me off to a room where a first class bar had been set up and insisted upon my drinking, which I refused to do. Curiosity started an investigation which revealed the fact that many of the exhibitors had set up bars in rooms in the hotel and that they considered this a necessary part of the convention. The convention wound up with a great banquet replete with rich food, long speeches, and vaudeville acts. The next morning furnished a grouch, a headache, and a determination to attend no more conventions of that organization.

Compare such a convention with one held a few years ago in a mid-western city that reshaped the entire conduct of a great industry. Determined, thoughtful men went all over the country to attend to business. The only social features came at the end when the delegates attended a baseball game and in the evening held a smoker where old friendships were renewed and new ones formed. There are at least a dozen of the first kind of convention to one of the latter. It seems high time that business refused to foot the bills for gatherings which from the nature of the program are foredoomed to produce no useful returns.

—C. J. Morrison, *Consulting Engineer, Meyer, Morrison & Company.*

Dismissal Wage

In an emergency, when ballast has to be thrown over to save the ship, many valuable pieces must be let go. So it is with employees. In cases where valuable men have to go, it creates a better feeling in the community and between the employer and employee, to make a friendly gesture and give a week or two salary. This gives the man a chance to look around and seek a new position with some discretion, and not have to grab the first opportunity, only to be dissatisfied later. The amount involved is trifling in comparison with the holding of men in comparative idleness for months. It eases the jolt of discharge, and in case of rehiring, creates a bond of sympathy, by showing a spirit of consideration which will be appreciated by most men.

—John S. Isdale, *Plant Engineer, International Silver Company.*

Free Advice

There comes a time in everyone's life, when one gets into difficulties and requires advice, especially those who are not in a position to pay for it. Most large firms today run welfare departments and the persons in charge are known as welfare superintendents. These are the persons to whom employees should turn if they require advice on any personal problem.

A man employed in the tool room of a machine tool factory had been under his local doctor for some time, and as he did not appear to be making satisfactory progress, it was suggested he should see a specialist. This man was not in a position to pay, so he informed the superintendent at the works of his trouble. The matter was taken up with the management, and arrangements were made for this man to go away and receive treatment, the firm paying a portion of the expenditure, allowing him to pay back his share in weekly instalments. This man soon regained his normal health, returned to work a new man, praising his firm and fully appreciating what they had done for him. It was not long before every man in the shop knew about it, and it was quite clear to many that the firm had their interests at heart.

It does not always follow that all cases are going to turn out like the one just mentioned; a lot will depend on whether the man is a good worker and of value to the firm. It should be made perfectly clear that help will be given only where the causes are unavoidable. If employees get themselves into trouble which could have been prevented they have only themselves to blame.

—T. R. Silver, *Birmingham, England.*

Brain Fag

A study of the causes of mental fatigue revealed these conditions:

1. Noisy location of the room.
2. Crowded and poorly arranged quarters.
3. Obsolete equipment.
4. Inadequate and poorly arranged lighting.
5. Loose organization, shiftlessness, and lack of discipline.
6. Lack of incentive to induce the senior designers to remain in our employ.
7. Inadequate salaries of senior members of the force.

We corrected these conditions, which resulted in mental and physical comfort for the men, produced more and better work, and reduced our department payroll and labor turnover.

—E. M. Kluck, *Chief Tool Designer, Sterling Engine Company.*

Buy Design

One instance where a set of detailed drawings would have meant repeat orders for a manufacturer, and where their absence most certainly resulted in his loss of profitable business, occurred on a job in Cuba. The outer end of the main shaft on one machine was carried on an elongated cast-steel bracket which, in the handling aboard ship, was first bent, and later broken off short. The machine was in immediate, urgent demand, and

when the ends of the broken bracket were matched, the serrations fitted perfectly. In the absence of any way to check the matter to the contrary, it was necessarily assumed that the position indicated by the matched broken parts must be the correct one, and the arm welded back to agree. As a result, the outer bearing of the shaft ran hot, the member was subjected to severe strains, and it was only a short time before the inevitable breakdown came. Complete drawings would have furnished us with a means to check the correct position of the bracket, and the distortion prior to the break would have been discovered and subsequent damage avoided.

The manufacturer need never fear that a set of drawings will set a rival up in business; if the other fellow must pirate a design it is far simpler for him to secure a complete machine and work from full-sized models. Nor need he fear that he will lose valuable repair or replacement orders, for any progressive firm is going to purchase such parts from the manufacturer, equipped to make them economically and right, if he be able to get the parts promptly. The customer is entitled to the opportunity to judge for himself if his necessity is so imperative as to sanction local work rather than an indeterminate wait for factory replacements.

—Elton Sterrett.

Customers are entitled to all the necessary data on their purchases, and most firms will cheerfully furnish any specific information that may be found desirable. But furnishing a full set of working drawings or prints, with standard or special machines, is a practice that would surely be disapproved by practically all established concerns, unless the designs and drawings have been paid for on an hourly basis and can therefore be considered as the customer's rightful property. Another exception that might justify supplying a full set of prints, would be where the equipment is going to a foreign country, or to some remote, isolated section which would preclude any dependence on the factory for repair parts.

As to duplicating drawings, for the copying of another concern's product, by disassembling the machine and drawing it detail for detail, this has been done often enough to convince us that if such trickery as this were further facilitated by good-naturedly sending out a complete set of prints to every customer who asked for them, the pirating of machine designs would be a frequent occurrence. As long as occasional questionable concerns are willing to stoop to such unethical acts, it seems wiser to make it difficult, rather than easy, to resort to such practices.

—A. W. Suiter,
Liberty Tool & Gage Works.

Inducing Ideas

Some time ago the writer had the opportunity of inaugurating a workable incentive plan in a plant engaged in the manufacture of experimental machinery and apparatus. The problem was approached from many angles, and many schemes were tried out, but all of them failed of their purpose because the nature of the work was nonrepetitive, involving the trial and error method of attack. The designer's situation is even more difficult than this.

The enthusiast's point of view is always distorted, and in the height of enthusiasm, the line of demarcation is lost sight of. Unfortunately, the time study and incentive enthusiast is found in the machine industry as elsewhere. It devolves, therefore, upon management to define the line of separation. Incentives in creative work are obstacles to clear, unbiased thinking and conducive to destruction of individuality. The best incentive I know of is a good pay for a good day's work.

—George Belbes,
Teletype Corporation.

I have witnessed several attempts to install incentives in the drawing office, but with the exception of one for the tracers, all proved unsatisfactory to both the engineers and the management. It is a fairly simple matter for the chief draftsman to set up standard time units for tracings and to apply his pet premium formula. Design, however, does not readily lend itself to such incentives. Attempts to hurry the latter usually end disastrously. Moreover, the designer resents such attempts to introduce high pressure shop methods into his technique.

—H. S. Deeley, *Planning Engineer,*
Johns Manville Company, Ltd.

Misguided Loyalty?

The policy of executives seeking to gain information through secondary channels is certainly not one to recommend. If the actions of the chief of a department are such as to be detrimental to the firm's interest, it will not be long before they are noticed, and a corrective applied. Loyalty to the firm and to individual members are not necessarily opposed; a man who willingly betrays his chief will have but little compunction in acting similarly towards his firm, if at any time he should deem it to be to his own advantage so to do. The inference, that a man who refuses to act in the way indicated is acting against the interests of his firm, is an illogical one. Second thought on the part of the executive would probably indorse this opinion if he were disposed to take an unbiased viewpoint.

—T. H. Hargrave,
Lancashire, England.

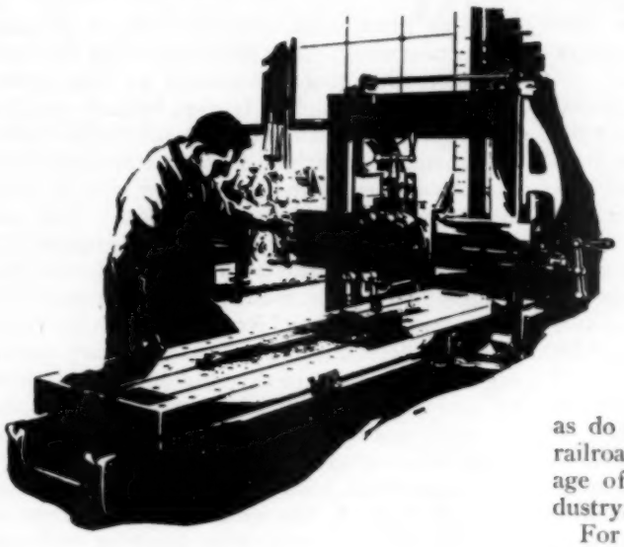
Dismissal Wage

It is impossible to get all manufacturing companies to agree on a policy of dismissal wages because of the varied experience of each. Hourly employees should not be treated as salaried employees when it comes to paying dismissal wages, because the burden of responsibility for the success of most organizations falls upon the salaried employees. They put in many hours during the course of a year for which they receive no remuneration. There are however, exceptions to this rule, as there are many hourly employees who are worth as much to their company as salaried employees. On the other hand there are so many more of the hourly employees, that the expense of paying dismissal wages to all by companies manufacturing seasonal products would be terrific. They would have very little chance to compete with products made in countries where dismissal wages are not paid. If by legislation, we could get the entire manufacturing world to pay a dismissal wage to all employees it would be great; but as long as we cannot, I believe the problem is best left to the companies to handle.

—A. Halliwell, *Superintendent,*
General Iron Works Company

OLD EQUIPMENT

IN THE SHOP



DOUGLAS T. HAMILTON
The Fellows Gear Shaper Company

Inspired by *American Machinist's* 1930 Inventory, this author contributes some pertinent facts from his own experience

THERE is considerable food for thought in the survey recently completed by *American Machinist*. This inventory was undertaken to determine the relative age of equipment used in the metal-working industries. In view of the fact that it was conducted through the medium of a questionnaire, it must of necessity be considered as approximate only. Nevertheless, it does convey a fair idea of the present status of most manufacturing plants as far as the age of the equipment in use is concerned.

The average for machines in use over ten years was found to be 48 per cent—four points greater than when the previous survey was made in 1925. This indicates that we are going backward instead of forward in our plans for equipment modernization. If it had been possible to make a complete and comprehensive survey, the conditions in the various industries from the standpoint of obsolescence would have been still more impressive. Large additions have been added to plant capacity, but comparatively little advancement has been made in equipment modernization.

It was to be expected that some industries would make a better showing than others in the use of modern machine tools. The aircraft industry for instance has only 4 per cent of its equipment over ten years of age. The high percentage of new tools was to be expected, because it has only been within recent years that this industry has been established on a manufacturing basis. The comparatively poor showing made by the railroad shops and the plants engaged in the manufacture of calculating machines, cash registers, and typewriters, will come as a surprise to some, although this also was to be expected. Those plants engaged in locomotive repair work evidently do not feel the same need for modern machines as do those engaged in manufacturing locomotives and railroad equipment, and thus have increased the percentage of obsolete equipment in use in this particular industry.

For the other industries mentioned, the reasons may not be so obvious. While some manufacturers of calculating machines and cash registers have added modern equipment within recent years, manufacturers of typewriters have not done so, and no doubt this is the reason for the poor showing of these industries. Had all three industries been presented separately, it would probably be found that from the standpoint of modernization, they would stand in the following order: calculating machines, cash registers and typewriters. It is, of course, true that some manufacturers of typewriters have pursued modernizing plans, but it is just as true that the rank and file have been backward in this respect. A detailed survey of some of the plants in this line of manufacture would reveal a preponderance of home-built or home-equipped machinery, dating back to the days when these industries were in advance of the procession. A large proportion of this equipment was either designed and built especially for one purpose; or standard machine tools of that day were arranged with special fixtures to handle the work. At the time this equipment was designed, it was considerably in advance of standard production machinery then produced by machine tool builders. Today, this condition, except in a few cases, is no longer true. Numerous instances could be cited where standard machines have replaced specially designed equipment and have greatly reduced production costs.

What has been explained in connection with the typewriting machine industry also applies to some extent to those companies manufacturing calculating machines and cash registers. One case, which was brought to the writer's attention, will serve to illustrate what in general applies in many more less specialized manufacturing industries. A certain manufacturer of cash registers had designed and built a battery of special machines for cutting teeth in segments. This equipment was producing these segments for 69 cents per 100 pieces. A standard

gear cutting machine of modern design, equipped with a suitable fixture replaced these special machines and cut the cost from 69 to 31 cents per 100 pieces.

According to the *American Machinist* Inventory, manufacturers of motor vehicles, including trucks, trailers, and passenger cars, were listed with 28 per cent of their equipment over ten years of age. Unfortunately for some few machine tool builders, the introduction of trailers into this group will cause some confusion, as only a comparatively small number sell equipment to this particular branch of the industry. Most machine tool builders would probably claim that approximately 40 per cent of their own products used by truck and passenger car manufacturers is over ten years of age.

The automotive industry on the other hand is credited as being the largest single market for machine tools in the country. During the past few years, particularly in 1928 and 1929, considerable new equipment went into this industry. Some machine tool builders sell as high as 75 per cent of their entire production to this industry and are naturally interested in any developments in this field. It has also been estimated that the automotive plants are equipped to turn out at least six million motor vehicles per year, or about 40 per cent more than the market normally can consume. This excess productive capacity is approximately the same as that generally considered as the percentage of obsolete equipment.

A similar analysis of the other industries covered in this survey would reveal what might be looked upon as a lack of appreciation of the value of a consistent program of modernization. The *American Machinist* is to be complimented for its efforts by machinery users and builders alike. Both can profit by analyzing the results and governing their future plans accordingly. Unquestionably, some of the industries which have been shown as backward in their modernization program will take stock of their condition and inaugurate a regular housecleaning with resulting profitable advantages. The chief value of this survey is that it indicates trends and can be used as a basis in an approach to more direct and specific marketing plans.

The manufacturer looks at equipment

Is age a true measure of obsolescence? Manufacturing equipment cannot be made obsolete by rules and formulas alone. As a matter of fact, few manufacturers as yet look upon their equipment from this standpoint. While it is more or less general practice and the Federal Government permits it, to charge off depreciation at the rate of ten per cent per year, which would obsolete a machine naturally in ten years, a manufacturer considers a machine which has been in his plant for ten years as worth more than its value as scrap. While the machine may have paid for itself several times over, he still considers his ten-year old machine as an asset.

The way most manufacturers feel about obsolete equipment is that it represents excess capacity, which is not costing them anything; it has more than paid for itself and therefore they are not penalizing themselves by having this equipment lying idle on their floors. In other words, it somewhat represents a hidden asset, which can be drawn upon when demand exceeds the productive capacity of their more modern machine tool layout. While this might appear as a fairly logical form of reasoning, it is not without its weak points. The old equipment requires floor space, heat, light, depreciation, and a certain amount of overhead expense for housing and insurance, although it may remain idle half the time or even more.

That the age of a machine tool is not always a true measuring stick for obsolescence is clearly shown when we consider the cutting tools used on the machine. When high speed steel was invented, it made necessary the replacement of a large amount of equipment—not necessarily because this equipment was over ten years of age, but because it had not been designed to handle this cutting tool to its highest efficiency.

The tool influences machine design

As an illustration, take the case of a lathe used for production work. Any improvement in the cutting ability of the cutting tool necessitates an improvement in the machine upon which it is used because machines should be so designed that the cutting tool is the limiting factor. When tungsten-carbide is fully introduced into production departments, another change will in some cases be demanded in machine tool design. This cutting tool demands much higher speeds and greater rigidity than is needed with high-speed steel. Any machine tool not designed to handle these new cutting tools at their best efficiency is obsolete, irrespective of its age. Machine tool designers, during the past few years, have been making rapid progress in design from the standpoint of ease of operation, rigidity of construction and accuracy. It is easily possible for a machine to be obsolete shortly after it leaves the maker's assembly line.

A recent talk with a plant manager threw an interesting side light on how many shop executives look at this subject. With considerable pride he pointed to a gear cutting machine which had been on his floor for twenty years. He was conscious of the fact that machines of this same type, but of recent design, would turn out at least 25 per cent more work than the machine on his floor. Yet, he did not consider it profitable to replace the machine because it was only working part time. You could not sell this manager a new machine based on obsolescence. The only possible way to interest him in installing new equipment is to show him that it would pay him in dollars and cents to do so. This involves several questions such as the cost of floor space, repairs, and other charges incident to keeping this machine in working order, as against the higher productive capacity and lowered fixed charges of a more modern machine.

At least one machine tool builder has decided on replacing his equipment every ten years. He paints a stripe on every machine in the plant once a year. At the end of five years, a stripe of different color is put on, and a still different one at the end of ten years. The age of any machine is visible at a glance. From the standpoint of the machine tool builder, obsolescence does not look so rosy as it would appear, because when a user considers that a machine tool has become unprofitable to operate, he does not scrap it. He sells it to a dealer for whatever it will bring. The dealer puts on a coat of paint—probably makes a few minor repairs—and it comes back on the market again. It thus competes with the sale of new equipment, instead of being relegated to the scrap heap. Some more satisfactory arrangement must be devised for disposing of obsolete machines before the full benefits of the idea of obsolescence can be attained.

A statement by Dr. Julius Klein in his interesting radio address on January 30 bears repeating at this time: "Through the use of constantly improved machinery, the path to progress lies"—a profitable motto for all to follow.

Change Gears for Gear Cutting

Discussion

FRANCIS W. SHAW
Consulting Engineer, Heywood, England

Another method for saving time when machining gears with unusual numbers of teeth

JOHN THOMAS (*AM*—Vol. 73, page 894) describes how he cut a gear with approximately 113 teeth, when he had no 113-tooth change gear at his disposal nor the time to make one. To do this, he calculated an approximate train which gave a remarkably good result. We all know that good approximations are possible, but most of us do not know how to find them. Mr. Thomas found that the exact gear ratio 24/113 could be closely represented by the compound ratio 25/58 x 34/69. But he omitted to reveal whether he was compelled to employ tedious trial and error methods or used some organized system of selection. Personally, I should like to know, as his method may be easier than any of those I am compelled to use. But I believe my procedure is at least more scientific than some I have seen employed which waste hour after hour of draftsmen's and machinists' time. Sam Trimbath (*AM*—Vol. 74, page 403) presents a plan for calculating change gears from a table of factors. The results obtained are accurate, and the only objection is that the rather voluminous table may not always be handy. Here is a method by which gear trains, both double and triple, may be derived with great accuracy without the use of tables.

Every machine, in which change gears are employed, has some fixed or constant ratio which modifies the change gear ratio. This constant is 24 in the machine to which Mr. Thomas' arrangement applies. This is readily obtained by noting the division obtained when the change gear ratio is unity. For purposes of illustration, the constant 24 is as suitable as any, and to compare to advantage different methods of computation, the prime number 113 will also be retained.

At the outset, it is essential to fix the maximum error permissible in a complete turn of the work, since the greater the allowable variation, the fewer may be the attempts needed to secure the required accuracy. Chance plays a considerable part in the final result. The ratio 24/113 is not one of the easiest to approximate, which is perhaps fortunate, because it provides an opportunity to demonstrate alternate methods.

In general, the more complex the gear train, the greater the accuracy obtainable and the fewer the trials for a satisfactory solution. The less restricted the change gear set, the less time may be lost in futile attempts. Tables of gear ratios or their logarithms may be of help, but they shall be ignored here for the benefit of those not possessing them.

Following Mr. Thomas, let the initial study be to approximate the train 24/113 by a 4-gear train comprising gears from a limited set such as that supplied with a standard B.&S. gear cutter. Realizing that the 113 must be eliminated, the first impression might be that sufficient accuracy might be obtained by a change of both figures. A few trials will show that this is not possible. The usual set contains no change gear of less than 24 teeth. If the 24-tooth gear be replaced by a 25-tooth gear, the 113-tooth gear would have to be replaced by a gear about 1/24 larger or a 117-tooth gear, which is also omitted from the customary set.

If a table of gear ratios is consulted, it is apparent that the closer the ratio is to unity, the less do consecutive ratios differ from one another with few exceptions. Therefore, if one pair of near-unity gears is replaced by either of the next pairs, finer corrections could be made in an incorrect ratio than by replacing a pair more remote from unity by the next ratio—again with certain exceptions. It then appears that if in an initial trial set includes a near-unity pair, the prospect of easy solution is distinctly advanced. The first step then is to see that the first trial train contains such a pair.

The obvious procedure is to convert the original fraction with the least possible change in value with an eye to numbers included in the change gear set or multiples or factors thereof. The nearest suitable fraction would seem to be 25/117 found by multiplying 113 by 25 and dividing by 24. The factors of 117 are 13, 3, and 3 of which 13 is included in the set as a multiple. The next nearest fraction is 25/116, in which 116 has the factors 29, 2, and 2—29 being a factor of the 58-tooth gear contained in most sets.

The next step is to convert one of these new fractions as closely as possible to the original ratio 24/113 by compounding it with another which will have a near unity value. In the absence of a definite system, such fractions as 34/35, 35/34, 75/76, or 76/75 might be tried with the prospect of striking the nearest one after 20 or 30 trials. Fractions with numerators and denominators not represented in the change gear set would of course be barred.

To eliminate as far as possible cut-and-try determination, the following method may be employed, since every fraction may be broken down to:

$$\frac{b}{a} = \frac{c}{d} \times \frac{e}{e \pm 1}$$

Trying first the ratio 25/117 which is slightly greater than 24/113:

$$\frac{24}{113} = \frac{25}{117} \times \frac{e}{e \pm 1}$$

From which: $113 \times 25\, e = 24 \times 117\, (e + 1)$

and $2{,}825\, e = 2{,}808\, e + 2{,}808$

whence $e = 165 + 3/17$

and $e + 1 = 166 + 3/17$

Therefore: $$\frac{24}{113} = \frac{25}{117} \times \frac{165\ 3/17}{166\ 3/17}$$

Dropping the fraction 3/17, the change gear train will be

$$\frac{25}{117} \times \frac{165}{166} = \frac{50}{78} \times \frac{55}{83} \times \frac{1}{2}$$

This is a suitable train for machines with change gears for all prime numbers below 100 and possessing pick-off or other gears by which the constant may be modified by simple ratios. This train indexes for 113.00073 teeth, the error being about 7 in 1,000,000. If instead of 25/117, 25/116 were selected, similar procedure would have resulted in Mr. Thomas' train, the division being for 112.9976 teeth with an error of about 21 in 1,000,000.

Six-Gear Trains

If after modifying the denominator for the base fraction, we do not succeed in getting a good enough approximation, the numerator should be changed and tried with different denominators. A simple arithmetical calculation will reveal that the fraction 28/132 of which 132 has very small factors is extremely close to 24/113. The gear train is determinable in this way:

$$\frac{24}{113} = \frac{28}{132} \times \frac{e}{e - 1} = \frac{28}{132} \times \frac{792}{791}$$

or, since 791 contains the original 113:

$$= \frac{28}{132} \times \frac{793}{792} \text{ (nearly)} = \frac{35}{40} \times \frac{26}{66} \times \frac{61}{99}$$

This is a triple train employing gears below 100, its division being for 113.00017 teeth, the error being about 1½ in 1,000,000.

Here is an analogous method in which the numerator and denominator of the correcting fraction differ by more than unity, but in which the numerator and denominators are increased or reduced by the same amounts.

Let 25/115 be the selected base fraction.

Then:

$$\frac{24}{113} = \frac{25}{115} \times \frac{552}{565} = \frac{25}{115} \times \frac{551}{564} \text{ (nearly)}$$

Since 565 is a multiple of 113.

$$\frac{24}{113} = \frac{5}{23} \times \frac{19}{12} \times \frac{29}{47} = \frac{25}{46} \times \frac{38}{60} \times \frac{29}{47}$$

All these numbers are suitable for change gears. These will produce an indexing of 113.0003 teeth, the error being less than 3 in 1,000,000.

NEW BOOKS

WAGES: A MEASURE OF TESTING THEIR ADEQUACY.—*By Morris E. Leeds and C. Canby Balderston. 79 pages, 6x9 in. Cloth board covers. Published by the University of Pennsylvania Press, Philadelphia, Pa. Price $1.50.*

Mr. Leeds is President of the manufacturing firm of Leeds & Northrup: Mr. Balderston is connected with the Industrial Research Department of the Wharton School of Finance, of the University of Pennsylvania.

The problem of the adequacy of wages is attacked largely from the viewpoint of the worker. The test of adequacy is whether the wage received is satisfying to the worker. In order that this factor may involve more than merely the desire of the workman, a technique and a standard of development are set up.

The idea, as stated, is not an attempt to set up a standard wage, but to set a minimum, below which wages are not adequate. This, of course, involved a study of the needs of the average worker.

More specifically this is a case study of wages in the Leeds & Northrup factory at Philadelphia, Pa.

On page 8 is a frank quotation from President Green of the American Federation of Labor, outlining the wage policy of organized labor. It states: "Higher money wages from an economic point of view do not improve the situation of the worker if prices increase more than money wages.

"Higher real wages from a social point of view do not improve the situation of the worker if productivity increases more than real wages.

"For higher productivity without corresponding increase of real wages means that the additional product has to be bought by others than the wage earner. This means that the social position of the wage earner in relation to other consumers becomes worse, because his standard of living will not advance proportionally with those of other groups."

The idea of a "social wage" is not new. In 1921 a high labor official stated, "Labor should be rewarded according to its needs, rather than its services rendered."

The cumulative impression left by the book is, that we should pay labor more wages so that it will be content, so that we can stimulate it to produce still more, and then repeat the cycle.

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WOOD IN AIRCRAFT CONSTRUCTION—*By Geo. W. Trayer, C.E. 276 pages, 6x9 in. Cloth-board covers. Published by the National Lumber Manufacturers Association, Washington, D. C. Price $2.50.*

Choice of materials is one of the most important problems confronting the airplane designer, and in spite of the increased use of metal there are yet places where wood may be best for the purpose. This volume is a very thorough study of the distribution, supply and production of aircraft woods, their strength, selection, seasoning, bending, gluing and protection. It takes up aircraft parts in detail and gives advanced methods for calculating strength of various parts. There is also a section that shows the structure of various woods and tells how to identify them. The author's connection with the N.A.C.A and his contact with the aircraft industry add authority to the contents and make a valuable addition to the airplane designer's library.

The Tool and Equipment Supervisor, His Organization

JOHN C. DENSE
Tool Engineer, Delco Appliance Corporation

PART NAME Pivot Bolt PART NO 15296

TOOL NO.	TOOL NAME	OPERATION	TOOL DRAWING COMPLETION DATE	TOOL COMPLETION DATE
T-2019	Header Dies	Head	10/15/22	11/1/22
T-1976	Block & Rest	Thread	10/15/22	11/1/22
T-2119	Drill Jig	Drill Head	10/15/22	11/1/22

Fig. 8

THE work in the tool engineering department is usually demanded on short notice, and a report of the status of this work is likely to be asked for and expected to be forthcoming quickly. Because of this it is necessary to keep a work file showing each tool to be designed, listed under the number of the part it is to be used on.

Nearly every job that comes through the tool engineering department is required to be in production by a certain date. After making allowances for building and trying out the tools, a definite date can be set when all of the designs for this certain job must be out of the tool engineering department. These cards are made out as shown in Fig. 8 and filed under this date.

The tool design order blank, Fig. 3, should also bear this delivery date, and after being recorded by the clerk on the work file is passed on to the group leader. In this way a check may be had on the amount of work to be accomplished in a given time, and the necessity for increasing the force or working overtime may be determined.

The first thing a new tool designer should experience upon entering the up-to-date tool engineering department as an employee, should be an opportunity of learning the working of the system in use. Filing methods and such things are necessary for him to know before he can begin, and these things can be explained best by being incorporated in a tool engineering standards book.

This book should show how to put titles on drawings, make out stock lists, make changes on drawings and make out drawing change slips, such as shown in Fig. 9. Methods of calling for fits between parts are shown in Fig. 10. In this book should also be shown the dimensions of machine tools which are necessary for the fitting of tooling. These may be gradually accumulated, as the necessity arises, or may be taken from prints obtainable from the machine-tool maker. An example of one of these sheets is shown in Fig. 11.

One of the prime objects of this standards book is the listing of standard parts to be used in the making up of jigs, fixtures, dies, etc.

The use of these parts not only expedites the designing of these tools but also the manufacture and repairing of them.

The use of these standard parts may be extended to cover drill and reamer bushings, clamps, levers, hand wheels for jigs and fixtures, jig bodies, keys, screws, etc., also, die sets, spring pads, die blocks, spring pad screws, springs, etc. Examples of these are shown in Figs. 12 and 13. The use of these or similar standards has become recognized as a time-saving feature.

Another method of saving time in the tool engineering department is the tabulated tool drawing. Such a drawing is shown at Fig. 14. This is a double compound die for washers and is tabulated for various sizes. This type of drawing may also be used for knurls, plug gages, ring gages, snap gages, certain types of dies, vise jaws, etc.

Not only is this a time saver from the designing standpoint, but also from the standpoint of the processing engineer or anyone else seeking information concerning special tooling, as the information contained on a drawing of this type shows all the tools of this par-

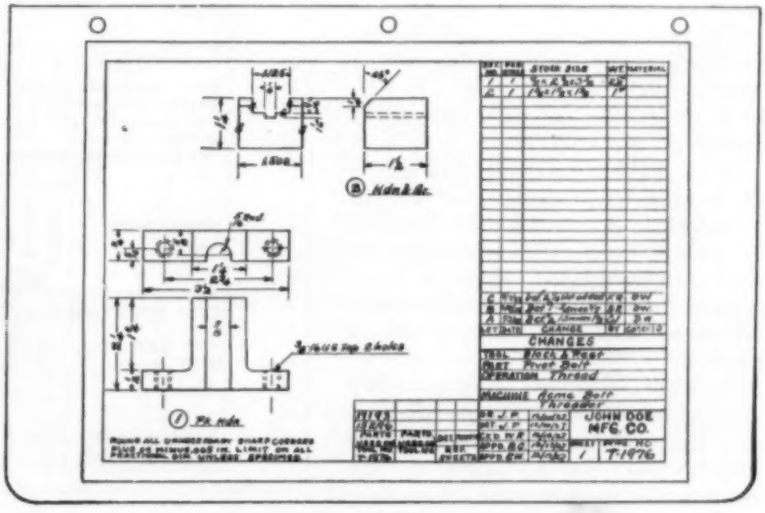
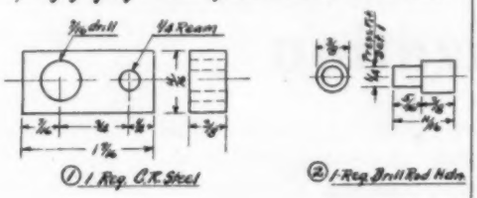


Fig. 9

RULES FOR DESIGNATION OF FITS BETWEEN PARTS.

When a plug or shaft is to be fitted into a hole, the standard practice should be to call for the fitting to be done on the male part if possible as this permits the use of a standard drill, reamer or plug gage for sizing the hole. See example.



The same ruling applies when specifying fits for threaded parts, the fitting should be called for on the male part.

The degree of fit desired should be designated thus. Press fit in Bet. 1, or Snug slip fit in Bet. 1, or Slip fit in Bet. 1, or Running fit in Bet. 1, as the conditions may warrant.

There will be occasions when it may be necessary to control the size of either the male or female fit to a definite size because of reasons beyond the designers control and in these few cases the fits will be called for in the manner shown above with this exception that the hole size will not call for a standard reamer size and will in most cases be marked "bore".

Fig. 10

ticular type at a glance and saves the time that would be required in looking up several drawings and comparing them.

The drawings which are made for tool designs are not generally finished to the extent that some other types of drawings are, because the amount of parts to be manufactured from these drawings is generally small. The question is just how far can this lack of detail be carried without having a bad effect on the finished tool. We will take for example a die drawing such as shown at Fig. 15. This is about as simple a type of tool drawing as it is possible to make and still convey to the tool maker sufficient information to enable him to construct the tool.

The general dimensions of die set, die block, punch, etc., together with a complete stock list, are given. At Fig. 16 is shown the same die completely detailed.

It is possible to make this die in the average tool room or tool shop at considerable saving when the detailed drawing is used. This eliminates the time used by the tool maker in figuring out the details and possibly making sketches for the lathe or shaper hand.

Another advantage is found when making repairs or replacing parts in this die. The part to be replaced may be machined up nearly to size, ready to be fitted into the die at short notice, because of the fact that the general dimensions of the die are known, whereas in the die made from the drawing shown at Fig. 15 the sizes of replacement parts are unknown until the die is disassembled and measured.

The problem of duplicating tools presents a strong argument in favor of the fully detailed drawing. It is almost impossible to make successive tools from the tool drawing shown at Fig. 21 and have them duplicates.

The prime duty of the tool engineering department is to design tools—good tools, the best that they can produce after exhausting every known source of information. This information may be gotten in many different ways and through many different sources; the tool designers themselves, the foremen in the departments where the tools are going to be used, the operators who have been using similar tools in the shop. None of these can the tool designer afford to ignore.

The method of deciding on new tools to be designed, writing the tool-design order slip, issuing it to the tool engineer by the processing engineer, recording it in the follow-up file, and passing it on to the group leader in the tool engineering department has been explained previously.

This tool design order slip is accompanied by whatever sketches or information the tool engineer may think necessary. The job is passed out to a tool designer by the group leader and a rough layout is made, being drawn in lightly. This is gone over with the tool engineer and then is taken to the tool and equipment supervisor for his approval. It is then taken to the general foreman of the department where the tool is to be used for his O.K. and suggestions, if any. If found to meet with general approval, the drawing is detailed and finished, ready for checking.

The objective hoped for in submitting the tool designs to the shop foreman will be very evident to anyone who has ever been placed in the tool engineer's position. First, to gain the confidence of these shop executives; second, to obtain, firsthand, the knowledge they have obtained through the operation of similar tools; and last, a psychological one, namely, to make these men feel that they have a part in the designing or making of these tools. They have a personal interest in them and feel a personal pride in striving to make them work or in reporting to the tool

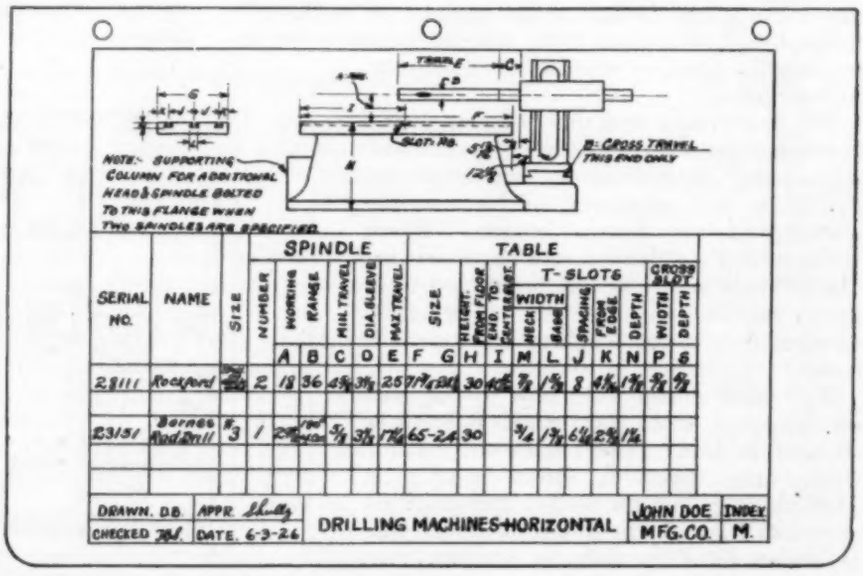

NOTE:- SUPPORTING COLUMN FOR ADDITIONAL HEAD & SPINDLE BOLTED TO THIS FLANGE WHEN TWO SPINDLES ARE SPECIFIED.
B: CROSS TRAVEL THIS END ONLY
SLOT No.
SPINDLE
TABLE
T-SLOTS
SERIAL NO.
NAME
SIZE
NUMBER
WORKING RANGE
MIN. TRAVEL
DIA. SLEEVE
MAX. TRAVEL
SIZE
HEIGHT FROM FLOOR TO CENTERLINE
WIDTH
SPACING
DEPTH
CROSS SLOT
WIDTH
DEPTH
A B C D E F G H I M L J K N P S
2811 Rockford 2 18 36 4 3 25 30 3/4 1 3/8 8 4 1/16 1 7/16 5/8 5/8
2315 Barnes Rod Drill No. 3 1 2 3/4 1 5/8 3 3/4 1 1/4 65-24 30 3/4 1 3/8 6 1/4 2 3/4 1 1/4
DRAWN. DB
CHECKED JBF
APPR. [illegible]
DATE. 6-3-26
DRILLING MACHINES-HORIZONTAL
JOHN DOE MFG. CO.
INDEX M.

Fig. 11

engineer any faults they may find in them, together with any suggestions for their improvement.

We have now carried the tool drawing up as far as the checker, and, as this is one of the most important stages through which the tool drawing passes, we will pause here for a brief discussion of this phase of the work.

The checker in a tool engineering department has an exacting and highly specialized job. This statement is not made thoughtlessly. This position requires a man with tact, technical and mathematical knowledge, and above all a sound practical shop training. The man who has had a wide and varied shop experience together with several years of toolmaking experience and who has a good mathematical foundation is more likely to make a good checker than the man who lacks shop experience.

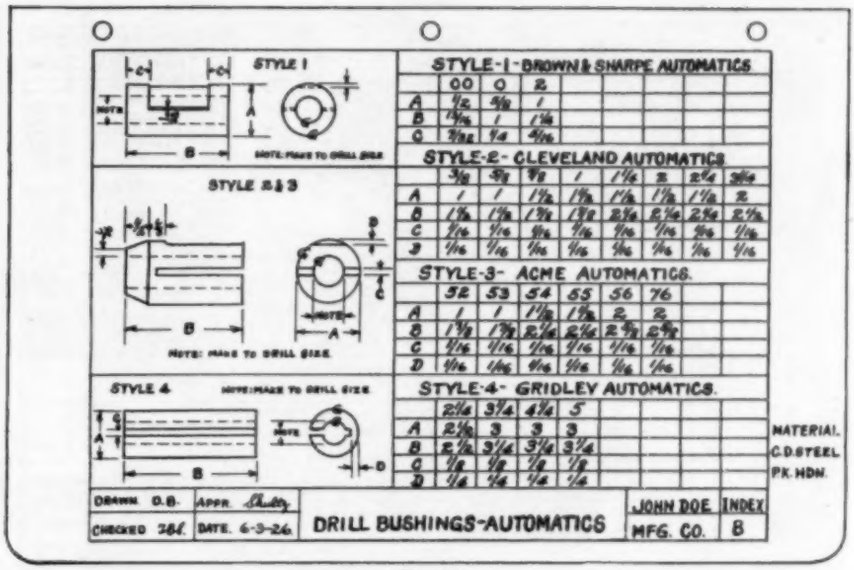


Fig. 12

The picking of a checker is a difficult job, except through long acquaintance with the party under consideration, his personality and methods. The best of tool designers do not always make good checkers through lack of the proper personality or through lack of patience or whatever else it is that makes good checkers.

Many years of observing the workings of tool engineering departments and of trying to find solutions for the correcting of evils found in them have led to the adoption of a plan whereby the work of checking may be governed or at least guided.

This plan embraces a set of rules for the guidance of the checker, the idea being to call to his attention all of the important features of design and construction which he should not overlook. Such a set of rules for checking jigs and fixtures is presented here, but not with the expectation that it will be found complete. Such a set of rules can never be guaranteed to be complete.

1—Title, part number, and drawing number
2—Reference notes to other drawings
3—All views to 3rd angle projection
4—Detail numbers arranged numerically
5—Standard castings wherever possible
6—Is weight of tool excessive
7—Is work supported under clamps
8—Dowel locations correct
9—Wearing parts easily replaced
10—Movements as simple as possible
11—Drill bushings of proper length
12—Drill bushings close enough to work
13—Clip clearance
14—Clearance for burr
15—Clearance for tool when breaking through
16—Lubrication provided where necessary
17—Provision for coolant on tool
18—Parts easily placed in and removed from tool
19—Clamping ears
20—Interference with machine
21—Drill bushings standard
22—Screws, nuts, keys, knobs, dowels, cams, latches, feet, etc., standard
23—Dimensions taken from proper point
24—Limits O. K.
25—Drawing dimensioned so tool maker does no figuring
26—All dimensions checked carefully
27—Stock list O. K.
28—Have changes made and check carefully before signing

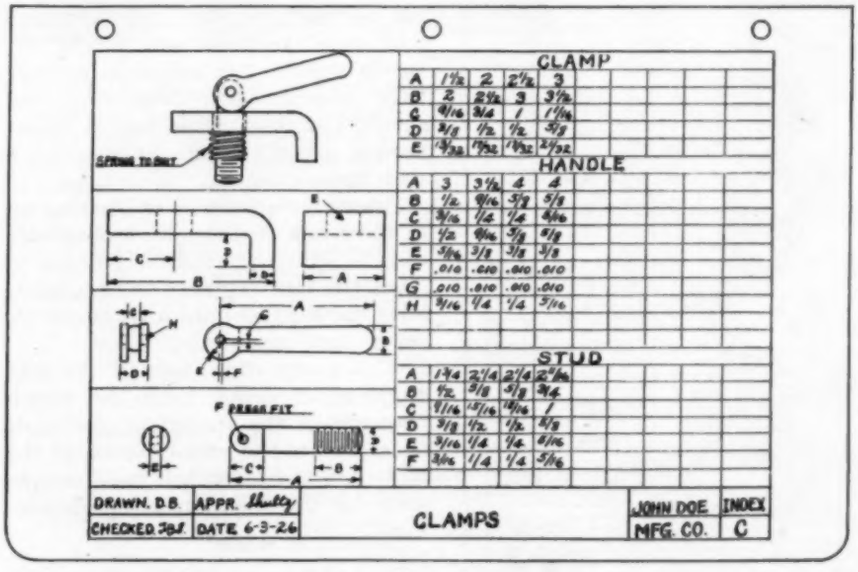
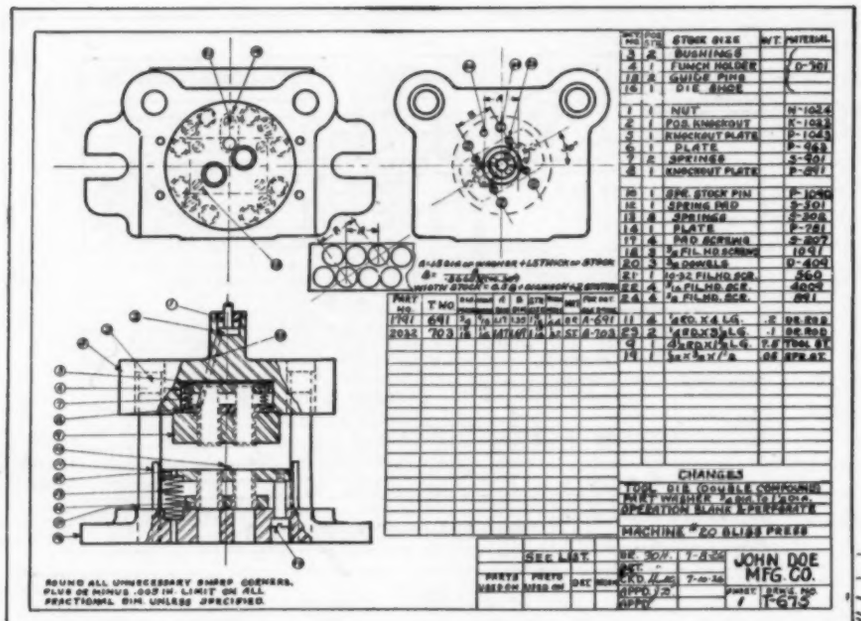


Fig. 13

The above list of remainders for the checker has been in use for some time and has had repeated additions made to it, but there is no doubt that continued use will show cause for many more additions. The importance of items that may be required on this list may vary considerably as the type of product being manufactured varies, so it is not possible to write a checking guide that will cover all phases of the manufacture of jigs and fixtures.

Similar lists to the above may be written, have been written and are in use for guidance in the checking of



Left, Fig. 14; below, Fig. 15; lower left, Fig. 16

dies; blanking dies, blank and draw dies, draw dies, forming dies, perforating dies, trimming dies, etc.

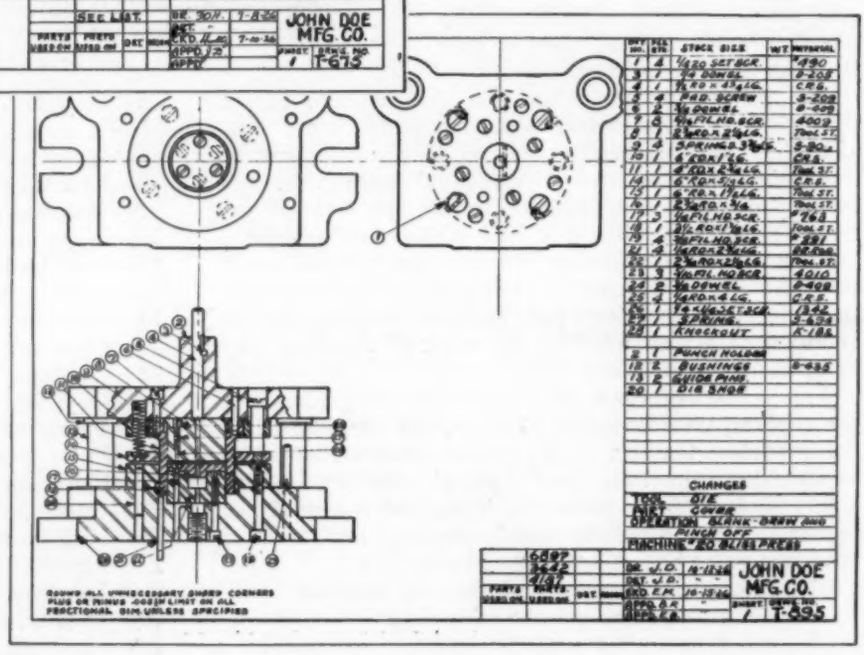
A list of this character may also be used for checking all sorts of gages, or, for that matter, this scheme may be used for guidance in checking drawings where the quantity of a certain type will warrant such a list.

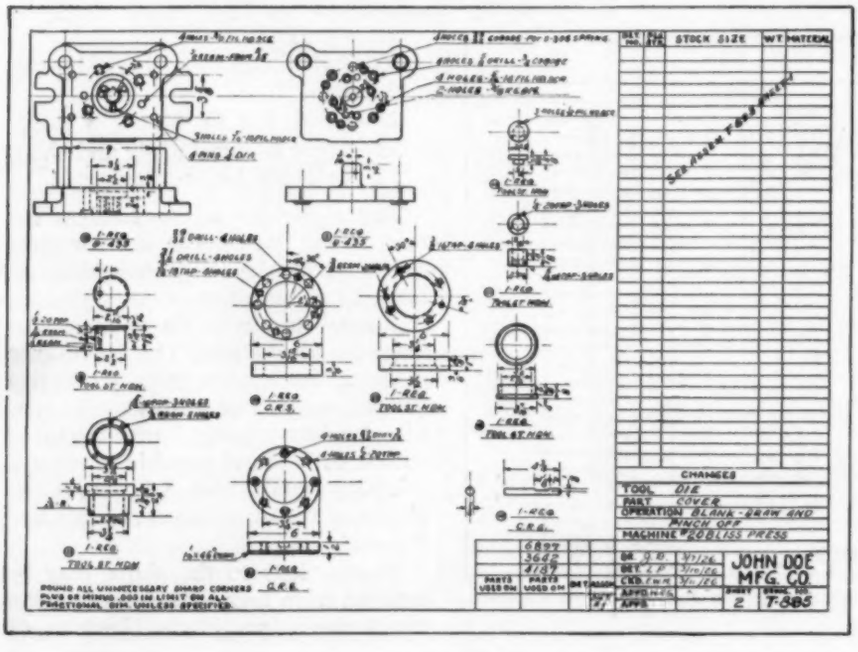
The finishing up of the tool drawing from the completion of the checking, on, is mostly a matter of signing, making records, seeing that the process engineering department has the necessary information to complete the operation sheets.

We have thus carried the tool drawing through its cycle to completion, and although this is considered to be the main duty of the tool engineer, he cannot afford to call his work finished and lose sight of the tool at this early stage of its development, but must keep in touch with it as it passes through the tool department, the tool inspection and is in the tool vault ready for trial and placing in production.

Here the tool engineer brings into play the group of men listed on the organization chart in his department as tool-trouble men.

These men are used also by the tool engineer to supervise the setting up and putting into production of all new tools. This has several advantages, first, that the tool engineer is assured





that the tool will be set up and tried out in conformation with the ideas that were designed into it, the designer and the tool engineer together have planned just how this tool should function and it should be set up and given a tryout in accordance with their ideas.

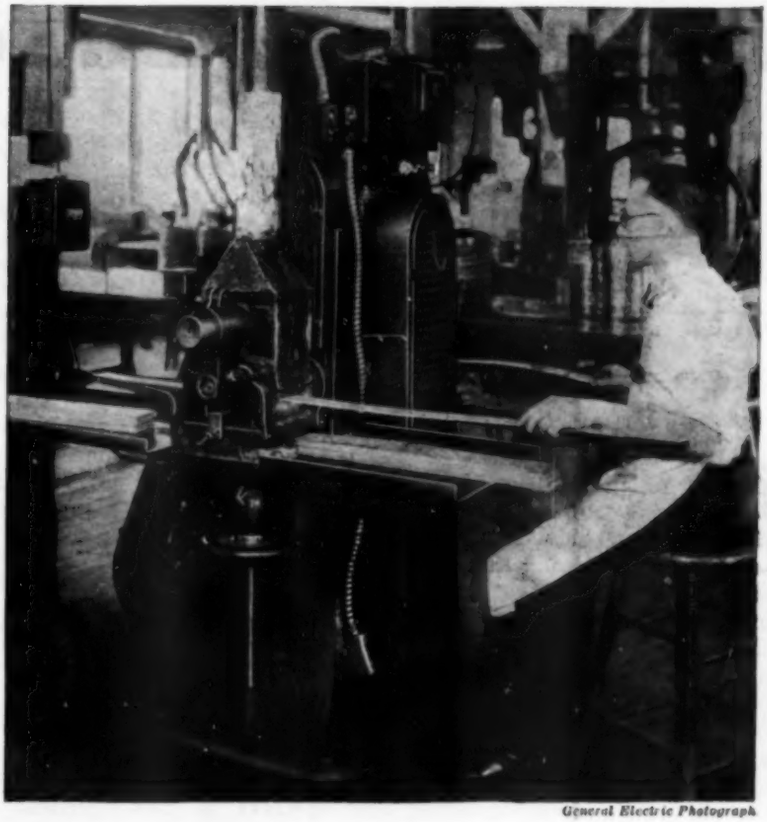
Another reason why the setting up of these new tools by the tool-trouble men is good practice is because it gives the tool engineer the responsibility for the tool until it is completed, set up, and approved.

This covers the work of the tool engineer in detail from the rough planning of the operations and tools to be used to the actual putting of the tools into operation and their acceptance by the manufacturing department.

Third of a series. The first two articles appeared on pages 855 and 909; Vol. 74.

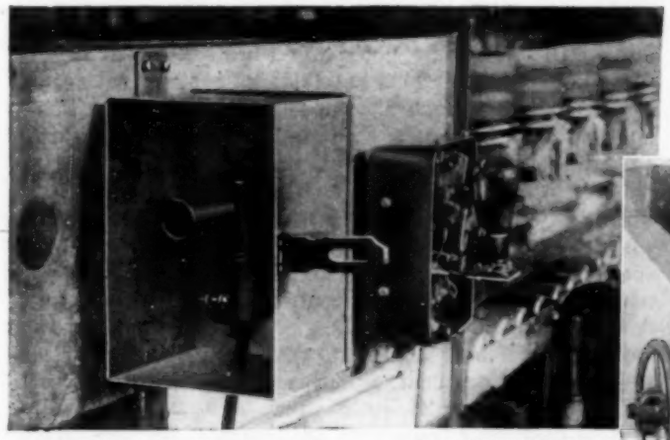
Industry's Electric Eyes

THE electric eye, or photo-electric cell, is rapidly supplanting the human eye for many industrial duties. It knows no fatigue and is not subject to the optical illusions which confuse the human eye, hence it is now being adopted for counting, turning off and on, recording color intensity, smoke density, controlling machines, regulating speed and tension, and even for protecting safes, watching for fires, setting off burglar alarms, opening doors, and other similar tasks. What its future uses may be only the future can show.



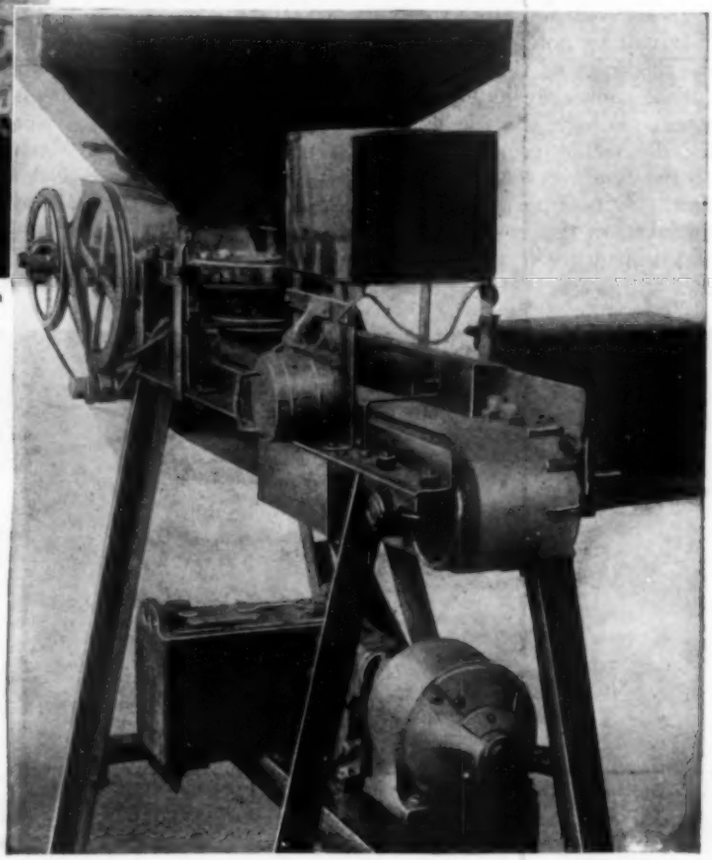
General Electric Photograph

Photo-electric magnetic counter for counting the number of mica strips while they are being checked for accuracy and thickness in a hydraulic press equipped with a micrometer adjustment. This accurate counter avoids the necessity of rechecking



General Electric Photograph

A photo-electric relay with a Veeder counter registering the number of refrigerating machine units as they are assembled and pass the light source. The photo-electric tube is mounted in the swinging housing, and the relay tube is in the further housing. Impulses from this unit actuate a counter over the foreman's desk in a remote part of the building



Lamp socket bases, as they pass along the conveyor belt of this machine, interrupt a beam of light and thus count themselves. Similar light-interruption devices permit other counting elements and control elements to function

Westinghouse Photograph

IDEAS FROM PRACTICAL MEN

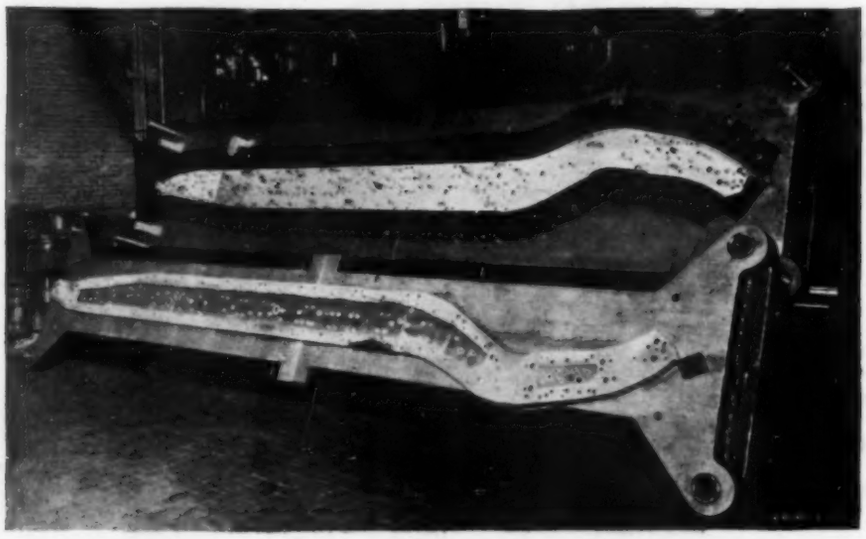
A Large Blanking and Piercing Die

G. F. OLIVER
Factory Manager, J. W. Murray Manufacturing Company
A Division of the Murray Corporation of America

ONE of the largest, if not the largest, compound blanking and piercing dies ever made for quantity production, and shown in the illustration, is in operation in our plant. The length of the die opening is 198¾ in.; the width at its widest point is 15 in.; and the total length of outline is 404 in. The weight of the complete die and punch is over 12 tons, necessitating the use of a crane to handle it in and out of the press. Besides blanking, the die pierces 162 holes simultaneously, the diameters of the largest and the smallest holes being 1⅝ and 7/32 in., respectively.

The material blanked and pierced is open-hearth steel of 0.30 carbon, having an elastic limit of 42,000 lb. The blanks are in multiples of two, the sheets being 32x199 in. and weighing, approximately, 290 lb. The force required for blanking and piercing is something less than 800 tons. This comparatively small force is sufficient for doing the work because the die is given a shear of ⅜ in., and the piercing punches are set back so that the blanking is done before the piercing.

It will be noted that the shear is equal to four times the thickness of the blank. A great many die designers do not appreciate how much plenty of shear relieves the strain on both the die and the press. Without shear, the die would require a force of nearly 2,000 tons to do the work, or enough to shear a bar 8x10 in. in section. By making the shear two, three, or four times the thickness of the metal to be blanked, considerable expense and difficulty will be eliminated in the operation of large dies and presses. Of course, such excessive shear is not always practical for small blanks of from ¼ to ½ in. in thickness, but if the die designer would add just a little more shear to his blanking dies, it would certainly relieve the press from undue strain and would increase the production per grind.



The press in which the die here illustrated is used is of 2,000 ton capacity, and is 18 ft. between the housings. It has a stroke of 16 in. and a shut height of 20 in. The bolster is of steel, 12 in. thick, and an 8-in. cast-iron ram spacer is used. Four men are required to operate the press, and the production is, approximately, 200 pieces per hour. The piece blanked and pierced by the die illustrated is for the side member of the chassis frame for a passenger automobile.

Making Accurate Bushings on a Production Basis

W. H. LEHMAN

We were confronted with the task of producing 6,000 hardened and ground bushings daily, such as the one shown at *A*. The bushings were turned out on automatic screw machines, the allowance for grinding the outsides being 0.012 in. The holes were broached, leaving an allowance of from 0.0025 to 0.0035 in. for internal grinding. Any more stock allowance for grinding the holes was not permissible if the internal grinders were to keep up with the production requirements.

When the outsides of the bushings were concentric with the holes, everything was all right. But anyone who has had experience with a job of this type on the automatics, knows that it is impossible to hold 100 per cent of the work to concentricity within the limits required. A lot of the bushings ran out anywhere from 0.005 to 0.007 in. The scrap was excessive, being often as high as 20 per cent, and this was the condition that had to be remedied.

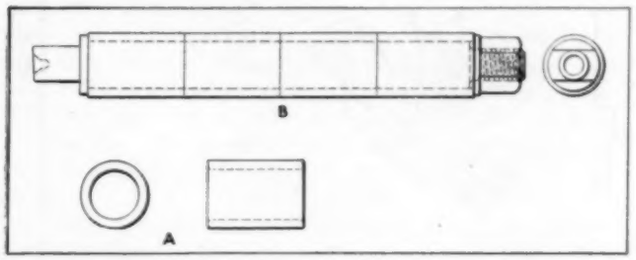
Heat-treatment required 18 hours. All the stock chasers in the plant were chasing the job. Everybody had headaches, and the inspectors in the screw-machine department were passing the buck to those in the grinding department. The situation was always distressing particularly when the factory manager had us in conference on the scrap report.

When it finally dawned upon us that the production of the screw machines could not be improved in quality, we decided to approach the problem from another angle. The methods we had been following were the usual ones, grinding the holes after hardening and then mounting the bushings on a press-fit mandrel for grinding the outsides. And this was where the trouble occurred.

Chucking the bushings from the outsides, and with a run out of from 0.005 to 0.006 in., the holes would not clean up. Right here we licked the job by reversing the sequence of the operations.

We made a mandrel, as at *B*, long enough to take four bushings at a time, secured by a nut. The mandrel was a slip fit for the bushings. Any that were too tight to slip on the mandrel were placed in a separate pan and were ground later on an undersized mandrel. Those that were too loose were placed in another pan and were later ground on an oversized mandrel. This operation brought the outsides concentric with the holes. When the bushings were chucked for internal grinding, the wheel made sparks all the way around the holes. At first we ran a few thousand bushings, allowing 0.003 in. for finish grinding the outsides after grinding the holes. However, as the inspection showed 100 per cent good work, we later ground the outsides to finished size in the first operation.

We were using 3-jaw universal chucks on the internal grinders, and the operators had to true the jaws at frequent intervals. But this type of chuck necessitated stopping the machines for every bushing. Later we equipped



the machines with spring collets, each one being operated from a lever attached to a draw-in rod. In consequence it became unnecessary to stop the machines for loading and unloading. The operators used their left hands for operating the levers and the right hands for loading and unloading, using the forefinger for unloading and the second finger for loading.

It was really surprising how long the collets would last without truing. We had expected that it would be necessary to true them frequently, and the inspectors were instructed to be on the alert and stop the job in case of lack of concentricity. However, this procedure was not necessary, since it was nothing unusual to run for over 200 hours before showing the slightest error in the work.

Scrap was almost entirely eliminated, the only rejections being for an occasional bad tool mark, or for hardening cracks. The outsides of the bushings were accurately round and showed 100 per cent perfect by the indicator, whereas when they were ground on the drive mandrel, the outsides were always more or less distorted. Also there was trouble with the spindle bearings and the grinding wheels; the operators, due to abnormal conditions, were constantly having trouble with these parts of the machines.

By the new method, we were able to keep ahead of production requirements. In a very short time we had stock in the storeroom, whereas before, the bushings had to be taken directly to the assembly line. Instead of disliking the job, the operators liked it and stuck to it. The price on the internal grinding was reduced from $1.20 to $1 per hundred, and the price on the external grinding from $1.10 to 75 cents for the same quantity, and every operator on the job was good for 100 bushings per hour. Under the old conditions, we were never able to estimate the quantity we were going to produce in a given time.

It does seem a bit unusual to talk about finishing the outsides of bushings before finishing the holes, but this method was the salvation of the job. While the method was worked out in the face of much opposition, the chief inspector reported that the bushings were the most perfect ever produced on the job.

■

An Accurate Depth Stop—*Discussion*

C. L. Henry

Beeston, Nottingham, England

The method described by Tom Wrigley (*AM*—Vol. 74, page 442), is ideal for producing a given thickness to very close tolerances on repetitive work, using either skilled or unskilled labor. While using practically the same method, I make a slight modification in the tools, which I think is an improvement. First, I make the pilot in the cutter convex on the end, so when it is in contact with the locating pin, there is little danger of small chips getting between the two and interfering with accuracy. Since the center of the pilot has very little rotating surface, a dead stop with very little wear is assured. Both the locating pin and the pilot are, of course, hardened.

Second, when machining both sides of a hub, or boss, I use one locating pin only. For facing the first side, the trip, or standard stop, on the machine is used. It can be set accurately enough for approximate dimensions. After one side of the batch of work has been machined, the machine stop is disengaged. In the second operation, the depth of cut is governed by the pilot in the cutter. For spot-facing work, having a thickness of $\frac{1}{8}$ in. or less, I use a hardened and ground steel plate attached to the machine table, and allow the pilot in the cutter to centralize the work and to contact with the plate as a stop.

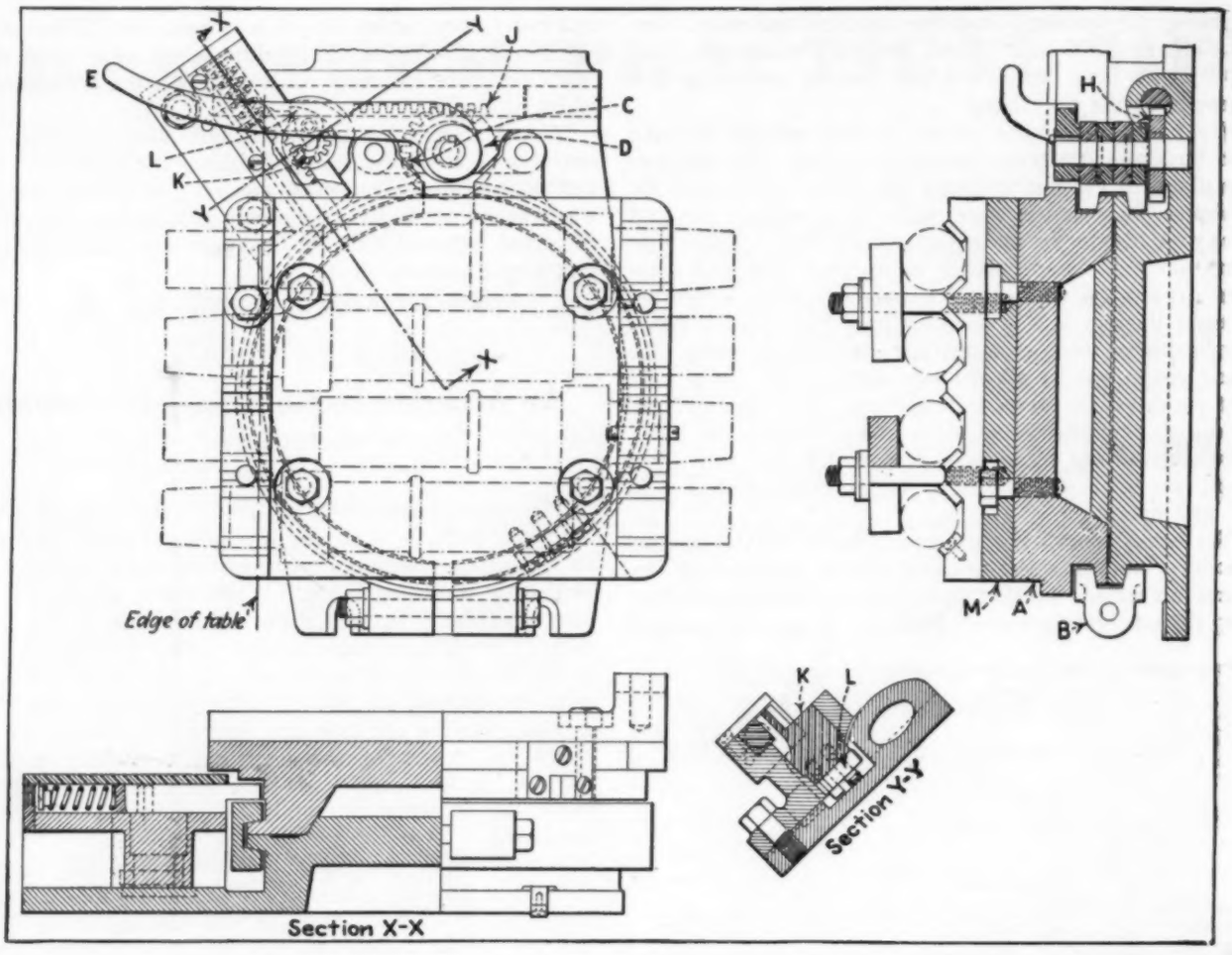
■

An Indexing Fixture for the Milling Machine

Fred A. Pearson

In the illustration is shown a rigid fixture of the quick-acting, indexing type. It was designed for squaring the ends of steel forgings in a shop where the machine tool equipment did not include a double-head milling machine. Fundamentally, the fixture is constructed on the turntable principle. It is rigidly held by a clamp ring that is tightened and loosened by a lever which jointly operates the index plunger. On the base is mounted the turntable *A*, which is centered on a conical seat. Both the base and the turntable have mating flanges that are beveled on opposite surfaces.

These flanges are engaged by the clamp ring *B*, made in halves and beveled to correspond to the bevel on the flanges. Adjustment of the clamping ring is made by a bolt passing through lugs on the ring at the front of the fixture. At the rear, the other ends of the clamping ring carry the knuckles *C* and *D*. These knuckles are pivoted



to links connected to an eccentric shaft, to which are keyed the operating lever *E* and the gear segment *H*. The rack *J* is operated by the gear segment.

On the base is mounted a bracket that contains the index plunger, the gear segment *K*, and the pawl *L*. On the turntable is the fixture block *M* that carries the necessary locating plates, studs and clamps, for locating and clamping the work. In the illustration, the turntable is shown in the locked position. To index it, the operating lever is moved away from the operator, turning the eccentric shaft and releasing the clamping ring. At the same time, the gear segment *H* is rotated, moving the rack *J* to the right. As the rack is moved, one edge of a pocket therein engages the pawl *L* and rotates it. The pawl strikes a pin in the gear segment *K* and starts it in rotation, bringing it into mesh with the rack on the index plunger. Thus the plunger is withdrawn from the index hole.

Before the operating lever is released, the turntable is slightly revolved to bring the index hole out of alignment with the plunger. When the operating lever has been released, the turntable is revolved by hand far enough to bring the next index hole opposite the plunger. The plunger then snaps into its hole, bringing the gear segment *K* and the pawl *L* back to their original positions. An escapement in the rack *J* permits the pawl to pass. To lock the turntable for the second operation, the operating lever is drawn toward the operator, turning the eccentric shaft and closing the clamping ring on the beveled surfaces of the flanges on the base and the turntable. At the same time, the gear segment *H* is rotated and brings the rack *J* back to its original position.

This fixture is quick in operation, sturdy and rigid. It can, to a certain extent, be used as a utility fixture by replacing the locating block with one suitable for the work.

■

A Simple Automatic Stop—*Discussion*

R. H. KASPER

Master Mechanic,
Steel Heddle Manufacturing Company

In discussing my article under the title given above (*AM*—Vol. 74, page 216), Charles H. Willey states, on page 590, that an automatic stop would not be necessary on the type of die described by me. Mr. Willey then goes on to describe a plain stop fitted to a die for doing work similar to that described in my article.

In so far as serving the purpose, Mr. Willey's design of stop is satisfactory, but he will not obtain the maximum production unless the press is operating at a slow speed. If the press is operating at a high speed, the operator must keep the incoming stock pressed against the side of the punch, so that it will pass under the punch as soon as the latter rises high enough to permit it to pass. If the piece cut off is light in weight, gravity will not act quickly enough to carry it out of the way of the incoming stock at each stroke of the press, so that the piece may be wedged against the stop.

In the design of the die shown in my article, the

stripper plate is carried well beyond the cutting edges, not for the purpose of stripping the stock, but to insure that the incoming stock will not ride under the piece cut off, which will ordinarily lift slightly when cut off unless prevented from doing so by the stripper plate. If Mr. Willey will move his stop closer to the die, so that the piece cut off will be short, I think he will find it impossible to operate the press continuously without getting rid of the pieces by some other means than gravity.

■

Preventing Loose Crank-Handles From Falling Off of Feed Screws

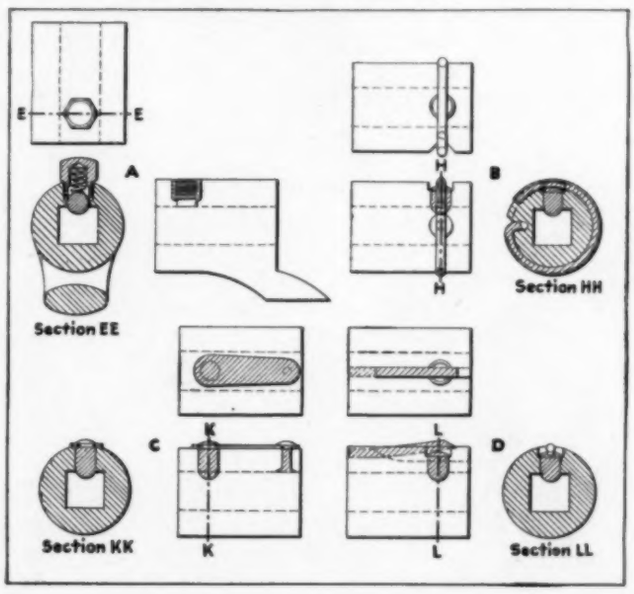
JOHN W. GERDEL

During my experience as a machinist and as a toolmaker, it has often fallen to my lot to have to operate planers and shapers that were not as new as they once were. Usually the holes in the removable crankhandles for operating the feed screws were so worn that the handles were very loose on the squared ends of the screws. Consequently, the vibrations of the machines would cause them to fall off.

Recently, I had occasion to do a lot of work in a shaper that was more than twenty years old and had seen considerable hard use. The original crankhandle was still in use and was so loose that it would not stay long on the screw. Since this condition was very annoying, I thought of several methods by which it could be remedied.

My first thought was to drill and tap a hole in the hub of the handle for a fine-thread screw. The screw was to be drilled nearly through lengthwise for a spring, and counterbored for a ball. The part of the hole entering the square hole in the handle was to be restricted for retaining the ball. With all parts in place, the spring would press the ball inward and into a dimple, one of which was to be provided in each flat of the squared end of the screw, the method being shown at *A* in the illustration. Since this method would require considerable work, I thought it would not be warranted.

I then thought of the method indicated at *B*. Here a hole is drilled in the hub of the handle to accommodate a shouldered stud having a rounded end. A groove is turned around the hub of the handle to receive a wire spring in the shape of a ring to bear on the stud. With the stud in place and the spring snapped into the groove, the action would be the same as in the previous case.



Still seeking a simpler method, I evolved the plan shown at *C*. Here a stud having a rounded end fits into a hole in the hub of the handle, the outer end of the stud being riveted to a flat spring, the spring being attached to the handle by a rivet. With all parts in place, the rounded end of the stud would be pressed into a dimple in the screw, as before. But since dirt and chips were likely to get under the spring and interfere with its operation, I abandoned the idea.

The thought of the simple method indicated at *D* then occurred to me. While this method is the same in principle as the one employing the flat spring, the spring employed is a piece of straight, round wire. A hole is drilled lengthwise of the hub of the handle for part of its length, and a groove is milled along the hub to meet the lengthwise hole. A stud having a rounded end is slipped into a hole in the hub, as before. The round-wire spring is then driven into the lengthwise hole, the outer end being in the groove and resting on the end of the stud. While the action of this device is the same as the ones in the previous cases, it is simpler than any of them and requires but little work. Since the spring can be driven out and replaced, any dirt or chips that may have gotten under it can easily be removed.

These methods are submitted in the hope that machine tool builders will make crank handles in which will be incorporated some simple device for preventing them from falling off of the feed screws. Should I ever have to buy a planer or a shaper, this point will surely have consideration, for it is very aggravating to have to pick up a crank handle from the floor each time it is wanted.

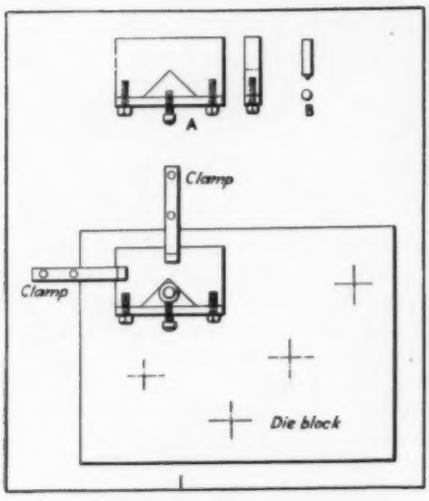
■

Short Cuts in Die Making
Discussion

CHARLES KUGLER

While great accuracy can be obtained by the method described by Charles E. Galls (*AM*—Vol. 74, page 688), there are other methods that are quicker, but not quite so accurate. Yet they are accurate enough for 50 per cent of the dies made. Over 25 years ago, I made the tool shown at *A*, in which bushings of various sizes are held. A piece of drill rod to fit the hole in the bushing has a teat turned on one end, as at *B*. The work is clamped to an angle plate having square sides, and is laid out and scribed by means of a height gage. The intersections of the lines are lightly prick punched for the easy location of the teat on the drill rod.

The tool is placed on the work as shown. A bushing is clamped in the V-block and the drill rod is placed in the bushing. After the tool has been located by the entrance of the teat on the drill rod into one of the punch marks, it is clamped in place. Then the hole is drilled and reamed. Other holes can be drilled and reamed by locating the tool as described. By this method it is not necessary that the edges of the work be square, since dependence upon the squareness of the edges of the angle plate. With this tool, work can be drilled and



reamed within a limit of 0.002 in., plus or minus, between holes.

In Mr. Gall's article, he states that the die he describes is not a job for the jig borer, because the holes are to be bottomed for bushings. As a matter of fact, the makers of both the Swiss and the Pratt & Whitney jig borers will supply reamers that cut on the ends, to be used in place of fly cutters after drilling. In addition to being ideal for Mr. Galls' die, such reamers increase production.

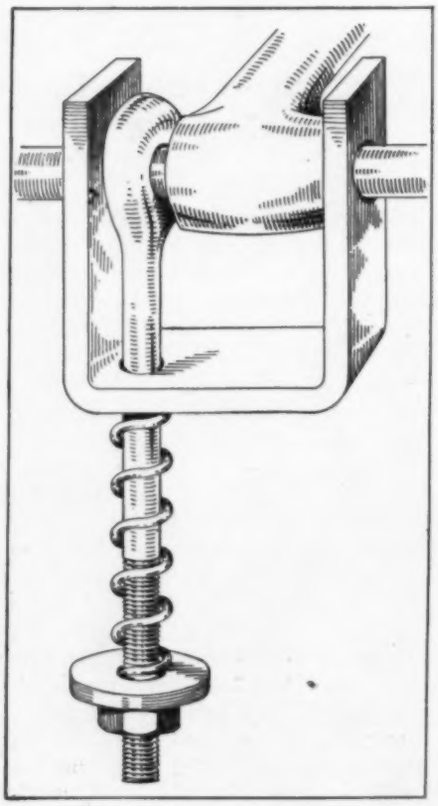
■

Preventing Slip of Belt Shifters

WALTER W. HAMMANT
Hamilton, Ontario, Canada

Often a belt shifter will develop the undesirable habit of slipping automatically into the stop or go positions, which is not only annoying but dangerous. The simple device shown in the illustration is an effective cure.

The device consists of a stiff spring; an eyebolt, having a hole slightly larger than the diameter of the shifter rod; and a U-strap, having clearance holes for the shifter rod and the body of the eyebolt. It is placed on the shifter rod at the arm of one of the countershaft hangers, as shown. By adjusting the nut under the spring, just enough friction can be put upon the shifter rod to hold it in any one position. The small amount of friction necessary to keep the shifter rod from slipping will not interfere with the smooth operation of the shifting apparatus.



SEEN AND HEARD

•

Oil and Water

CLOSE, accurate work does not mix too well in the same department with jobs that have to be put out at a price and on which close tolerances are not important. This is the statement of Harvey L. Spaunburg, chief engineer of Veeder-Root Incorporated, and is based on a long experience with many varieties of accurate work on castings, stampings, and screw machine products. The statement is especially true where tool and die work is involved.

It actually costs money in extra instructions, precautions, and supervision to prevent high-class toolmakers from giving the extra "licks" that make the fine jobs. On the other hand, it is likely to cost more in supervision to make the ordinary workman produce the close job than it would be to get a higher-priced workman in the first place. Having both classes of work side by side in the same department, even when different workmen are employed on the different jobs, is likely to be a costly procedure. Perhaps that is why job shops seem to array themselves into two distinct classes, high and ordinary, with few or none capable of handling economically any job that comes up.

Those Used Razor Blades

OLD-TIME barbers magnetized their straight razors with a permanent magnet after honing. Recently, several patents have been issued on safety-razor blade sharpeners of the magnetic type. These arrangements use permanent magnets, the blade being held at right angles to the magnet surface with the edge almost, but not quite, touching. E. T. Birdsall, Chief Engineer of the Lawrance Engineering & Research Corporation, New York City, upon looking over the patents, decided that the same object could be accomplished with a magnetic chuck. He tried it, it worked, so he told us. We're telling you. He suggests laying the blade flat on the chuck with one of the lines of insulation in the center of the blade. Then close the switch for half a minute, open it, turn the blade over, repeat the treatment, and you have a resharpened blade.

Long Hauls on Castings

PATRONIZING home industry is a catching slogan, and most of us would prefer to deal near home for several reasons. But when the home-town foundry cannot give us castings as good or as cheaply as a distant foundry, what's the answer? And when this foundry is seven hundred miles away, yet can pay freight to our door and deliver a better casting under the local foundry's price, what are we going to do about it? Is the distant foundry losing money to favor us or to spite the local foundry? Or is it a case of better equipment and better methods? And when the manager of the local foundry says he can't afford to put in new equipment because it is losing business, should we send for the sheriff or the brain specialists?

An Appraisal of Nitriding

A SUMMARY of nitriding was presented two years ago by Dr. Adolph Fry. Accepting his classification, and discussing the points in order, Marcus A. Grossman, vice-president of the Republic Research Corporation, gave these present views in an American Iron & Steel Institute paper:

"The nitriding process, if handled properly, gives surface hardness with practically no distortion." The only possible distortion occurs if pieces are supported improperly while at temperature during nitriding, except in certain instances noted later. The term "distortion" is here restricted to its proper sense of change of shape, and one finds usually no change of shape in nitriding. There is, however, a slight increase in size, commonly termed "growth," usually negligible. The amount of growth is of the order of 0.001 to 0.002 in. per in. at usual nitriding temperatures, but is greater when the nitriding temperature is higher. This is an additional reason for avoiding high nitriding temperatures in the initial stages. This same growth may also in certain cases cause distortion. Obviously, if a thin sheet is nitrided and is protected on one side from nitriding (as by tinning) the unprotected side will nitride and grow, causing the sheet to curl. Similarly, pieces of complicated shape with marked differences in cross-section may suffer distortion.

"Physical properties of the core are not changed by nitriding." Present practice in nitriding steels is to give the hot-rolled steel a preliminary heat-treatment, consisting in quenching or air-cooling from above the critical temperature, say from 1,700 to 1,750 deg. F. (925 to 950 deg. C.) and then to reheat to some temperature above the temperature of nitriding. Obviously, if the reheating or tempering is done at 1,300 deg. F., a subsequent nitriding at 950 deg. F. is not likely to affect further the core properties. However, a useful second nitriding stage at 1,150 to 1,200 deg. F. is often practiced to advantage after the 950 deg. F. nitriding, in which case the preliminary tempering before nitriding should be governed accordingly.

"Hardness and wear resistance are higher than those of any other steel treating process." This still holds.

"Hardness is not injured by tempering temperatures even above 950 deg. F. (510 deg. C.)" This presumably refers to a reheating after the nitriding, and has reference to the hardness at room temperature after cooling down from the tempering temperature. The statement holds for temperatures of at least several hundred degrees above the nitriding temperature of 950 deg. F. (510 deg. C.) The time at such elevated temperature must not, however, be extended inordinately. It should be emphasized that this refers only to the properties of the hardened case, when surface effects are carefully avoided.

"Nitrided parts are free of internal stresses, therefore free from aging effects." In regard to aging effects, it is perhaps proper to mention temper brittleness, which was sometimes, but not always, encountered when nickel was used in the alloy. This brittleness, which develops on cooling from the nitriding, is a phenomenon whose nature is not yet well understood, and although it is often found when nickel is present, it does not necessarily or universally accompany it.

"Nitrided parts are rust-resisting to a certain extent." To take full advantage of the rust resistance, which is often present, it is advisable to use the original nitrided surface wherever possible and to do no grinding after nitriding.

"The process may be adapted to various requirements . . . by selecting a nitriding steel of the proper composition for each purpose." It should be observed that, whereas Fry's illustration of this point shows differences in the hardness and depth of nitrided case, the present search for improvement in the United States finds itself more concerned with the core. In most applications, a case hardness well above 800 Vickers is obtained and is adequate. That is, the steels which have been adopted as tentative standards are of such composition that they give hardness of at least 800 to 900 Vickers. If greater depth of case is desired, it is secured by extending the time of nitriding or by using a duplex cycle with a higher nitriding temperature toward the end of the run.

"Best results are obtained by quenching and tempering the raw material and then carrying out the machining and nitriding operations." The quenching, or sometimes air-cooling, from a temperature well above the critical point, i.e., from say 1,725 deg. F., gives a uniform structure, free of large areas of ferrite. As a result, the subsequent nitrided layer is much more uniform and tough.

"Various nitriding agents have been tested." At the present time, practically all nitriding is done in ammonia. A suggestion has been made regarding the use of molten cyanides, which give a hard but extremely thin case. Circulating ammonia gas is the almost universal present-day nitriding agent.

"The use of a fan causes circulation and will help to give uniform nitriding." This was found to overcome the lack of uniformity in different pieces in the same nitriding box.

"The following should be avoided: surface oxidation, foreign metals touching the steel, foreign materials in the ammonia." Surface oxidation, especially decarburization, has been shown to result in a very brittle (almost friable) case. This matter of surface oxidation is one of the most serious causes of failures encountered in present-day nitriding practice. The statement has been made that the presence of decarburized, oxidized surfaces before nitriding leads to more failures of nitrided parts than any other single cause. These defective cases are very brittle and result in early spalling of the piece in service. Foreign metals susceptible of nitriding sometimes have an unexpected effect in retarding nitriding, and this is equally true of the nitriding containers themselves. Foreign materials in the ammonia, such as benzol, have at times been used in an attempt to minimize decarburization.

There are a number of points on which evidence has accumulated in the past two years. Briefly, they are:

It was found that with many of the metal containers used as nitriding pots, the depth of case obtained on the pieces being hardened decreased with continued use of the nitriding container over long periods of time. If the container was replaced, the nitriding became again as good as ever. The conclusion was inescapable that a change occurs on the inside surface of the container which decreases the efficiency of the ammonia in nitriding. This was a serious obstacle, and the data at hand indicate that only two successful containers have been developed up to the present time. One of these, an early foreign development, consisted in using as container a nickel-chromium alloy containing 25 per cent chromium and 20 per cent nickel. A more recent development uses a container enameled on the inside. These enameled containers seem highly promising, one of them having been in service already for 2,700 nitriding hours.

For protecting certain parts against nitriding, a tin coating still appears to be best. Pieces may be tinned hot using sometimes an alloy half tin and half lead, or the regions may be given a coating of tin electrolytically. Water-glass mixtures give some protection.

Applications which have proved unsuitable are:

In articles like sand spray nozzles, nitrided steel has failed to give satisfaction on account of the comparatively shallow depth of case. Even with the very hard hardness, the surface case is soon abraded away, then the unhardened material below offers little resistance.

In the presence of mineral acids nitrided surfaces offer very little resistance and such applications hold very little promise. Furthermore, in neutral solutions there should be no foreign metals, such as brass in contact, else corrosion is very rapid. In alkaline solutions, however, nitrided surfaces are satisfactorily resistant.

Where there is heavy or repeated impact, such as in clash gears or impact gears, commonly used nitriding steels do not have sufficient core strength. The case is soon cracked and the article is no longer useful.

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• • • • SHOP EQUIPMENT NEWS

Watson-Stillman Plate Bending and Forming Hydraulic Brake

Features of the plate bending and forming hydraulic brake, announced by The Watson-Stillman Company, Roselle, N. J., are speedy operation, a large range both for shape and size of the work, sensitive control of speed, and low maintenance cost. The steel frame can be either welded or riveted. The large open ends allow endwise removal of the finished piece and also make possible the bending of pieces which might be longer than the bending die, thus extending the lengthwise capacity of the machine to suit any existing length of plate. Dimensions of the end opening and the length of the bed can be varied to suit requirements. If desired, the frame can, in many instances, be fabricated by the user.

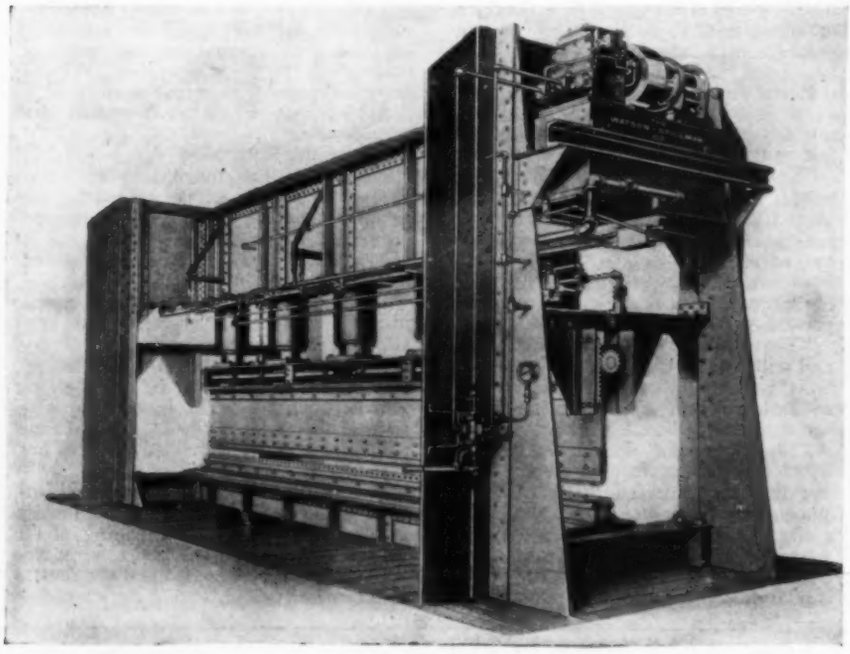
The bending beam is held in alignment with the base by means of a parallel motion arrangement and is operated by hydraulic cylinders. The cylinders are installed on fixed centers at equal spacings to give equal loading over the length of the bending die, or on irregular spacings so as to exert a greater load at a predetermined point. The return stroke of the beam is also accomplished hydraulically.

The cylinders can be operated in multiple or in any grouping of one, two or three at a time, and are controlled simultaneously by one lever valve. Each cylinder can be cut in or out of operation by a tell-tale valve-coupling mechanism. The opening between the steel rails used for the bottom blocks is readily changed by using pipe spacers and bolts of different lengths, and is quickly adjusted to suit bends of various radii, including conical-shaped sections.

The Oilgear pump operates at a pressure of 2,500 lb. per sq.in. maximum and has a variable-delivery discharge. The discharge on the return stroke of the cylinders goes to an oil reservoir in the pump and motor base. This reservoir also acts as a prefill tank for quick operation when the press is not under load. All moving parts of the machine are also lubricated by the oil.

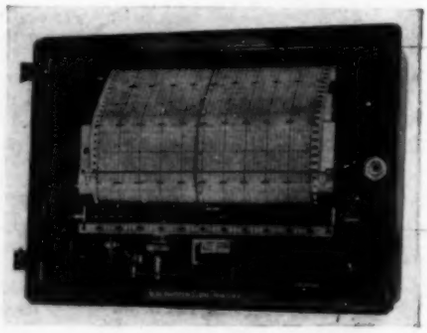
Operation of the brake is controlled by a single lever valve provided with a swivel handle. If desired, electric light signals can be installed close to the operating position to indicate the limit position of the bending die, so that the bending and return strokes can be held to that required on the work being done. This feature is valuable where a number of similar parts are being put through at one time.

The brake is being offered in 250, 500 and 1,000 ton capacities.



Brown Improved Potentiometer Pyrometer

Many improvements have been made in the potentiometer pyrometer announced by the Brown Instrument Company, Philadelphia, Pa. This instrument is available in indicating, recording, multiple recording and controlling types. Primarily, the galvanometer has been designed to have a uniform response under all practical operating conditions. Charts and scales, which are 12 in. wide, conform to the latest calibration values for iron-constantan, chrome-alumel, and platinum-rhodium thermocouples. A humidity compensator is built into the instrument to correct automatically the pen position under all conditions of operation to offset errors arising from expansion and contraction of the strip paper charts. Such errors may amount to 1 per cent.



The potentiometer has a dustproof case equally suitable for wall mounting, front-of-board mounting, flush-type panel mounting or table mounting. The case is entirely enclosed and the galvanometer is likewise enclosed in an inside compartment with a glass window. The galvanometer pointer and suspensions are relieved of practically all stress by the introduction of a secondary pointer system, whereby a secondary pointer assumes a position in magnified proportion to the galvanometer pointer and then governs the adjustments of pen and slide-wire contact. Automatic control of the instrument is obtained through mercury switches which can handle up to 50 amp. at 220 volts. Stainless steel is extensively used; bearings are of bronze or nickel silver. The case, door and frame are aluminum die castings, heavily enameled, and the door handle with lock is chromium plated to provide good appearance.

Champion Gage Protector Assembly

Niles No. 6 End Drive Lathe

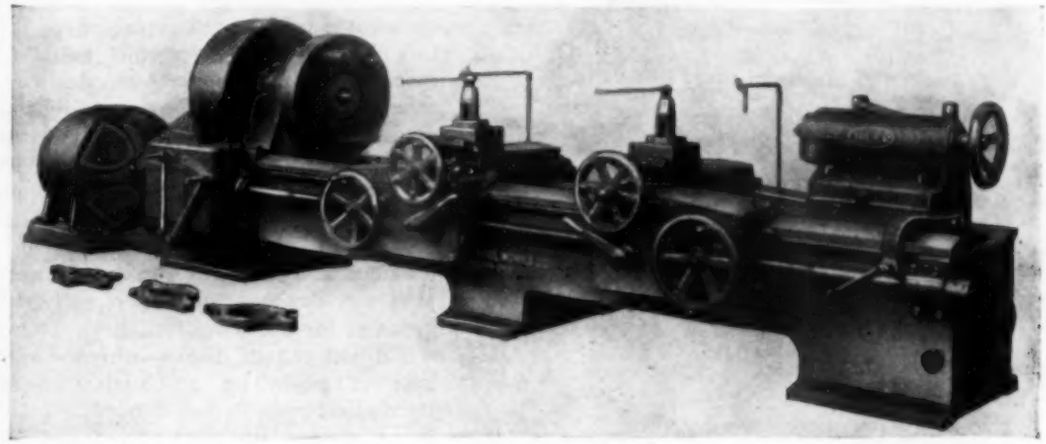
A No. 6 end drive lathe with two carriages has been placed on the market by The Niles Tool Works Company, Division General Machinery Corporation, Hamilton, Ohio. This lathe is a high-production machine suitable for turning axles, forgings, piston rods, crankpins, brake beam ends, and other parts, and for precision work as well as for rough turning.

The headstock is fully inclosed. The main drive gear and pinion are of steel and of the herringbone type. End thrust is taken up by a series of bronze liners, one rotating in an oil-filled trough to provide continuous lubrication. The faceplate is furnished to suit requirements.

The feed box is fully inclosed and mounted on the front face of the bed adjacent to the headstock. All feeds are driven through sliding steel gears. A centralized oiling system assures lubrication.

The two carriages can be arranged to suit requirements. They have longitudinal feed through half nuts engaging the leadscrew. Hand longitudinal traverse and hand cross feed to the tool are also provided. The aprons are of double-walled construction. The tailstock can be arranged with either a live or dead center, and it is made up of two sections. The top section has a slight cross adjustment for taper turning. The tailstock is traversed by rack and pinion, and the spindle has in and out movement by means of a handwheel. A motor-driven rotary pump unit is attached to the rear of the machine.

Specifications are as follows: swing over bed shears, 33 in., over toolslide, 16 in.; distance between centers (or to suit), 9 ft.; feeds, $\frac{1}{32}$, $\frac{1}{16}$, $\frac{1}{8}$, and $\frac{3}{16}$ in.; speeds to driving head, 16 to 48 r.p.m. in four steps; motor, 25 hp.; and floor space, 21 by 4½ ft.



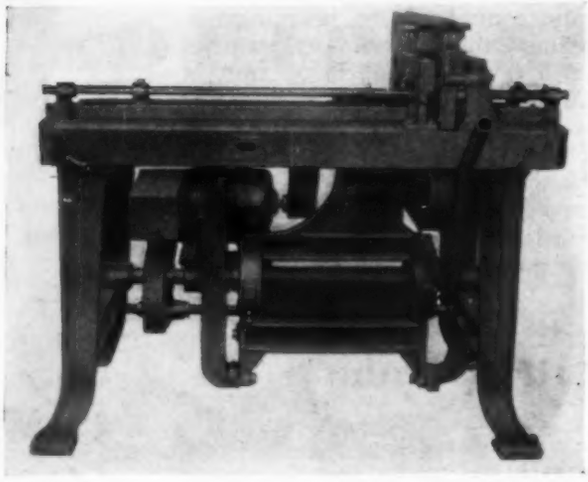
Both precision and rough turning of axles, forgings, and brake beam ends can be done on this Niles No. 6 End Drive Lathe

Champion Gage Protector

Protection to gages used on air and hydraulic lines is afforded by the gage protector announced by Champion & Barber, Inc., 576 Subway Terminal Building, Los Angeles, Calif. This gage protector eliminates passage of injurious fluids or solids into the tube or movement of the gage. It increases accurate service life and makes an ordinary gage into an all-purpose type, eliminating special adaptation for special conditions. It is comprised of a three-part, bronze bodied, rubber-bulbed pressure transmitting instrument. The pressure transmitting bulb is filled with glycerine or castor oil, and is at all times in direct contact with the exterior line pressures and the interior bulb fluid pressures. The bulb is specially treated for resistance to acids and other fluids. The parts of the gage protector are as follows: (1) main body; (2) needle valve adjustment screw for pulsator control; (3) packing and lock nuts; (4) neck or gage protector, and (5) main body of protector, containing the pressure bulb.

Campbell Model 30 Cut-Off Machine

For cutting extra wide stock with an abrasive disk, the Andrew C. Campbell, Inc., Bridgeport, Conn., has announced the Model 30 machine. Materials up to 1 in. thick and 16 in. wide can be cut at the rate of 2 to 12 seconds per cut depending upon the characteristics of the material. Nickel



Campbell No. 30 Cut-Off Machine for wide stock

silver, soft iron, hardened high-speed steel, and similar materials can be cut up to ¾ in. thick and 6 in. wide. If these materials are thinner, wider cuts can be made.

The travel arm for the cutting disk is arranged so that the spindle travels parallel to the top of the table without the use of slides. A straight edge is provided for locating the work so that the proper angle cut may be made. Quick-acting adjustable clamps hold the work firmly to the table.

The motor is started and stopped by a push button located conveniently. Welded steel guards protect the operator. Six V-belts furnish drive.

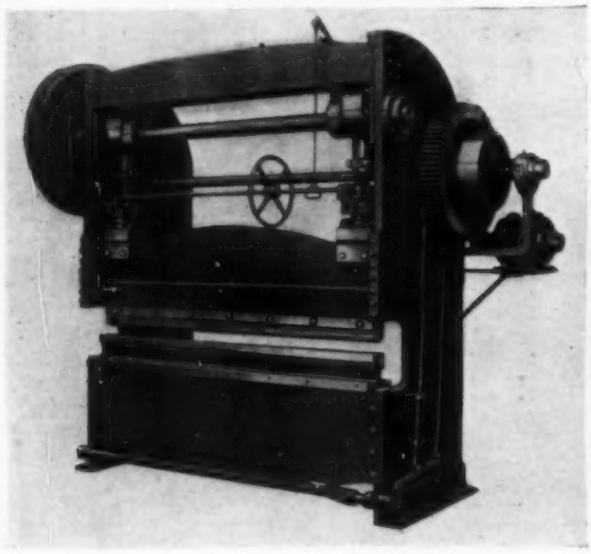
Dreis & Krump Light Arc-Welded Press Brake

For production of sheet-metal products, the Dreis & Krump Manufacturing Company, 74th Street & Loomis Boulevard, Chicago, Ill., has developed a light arc-welded press brake. Such sheet metal products include stoves, ranges, refrigerators, soda fountains, furniture, and a great variety of sheet-metal specialties.

The machine is built entirely of steel, arc-welded. The gear wheel is also made of a welded steel section. A deep gap in the one-piece housing permits work longer than the die length to be passed through the machine from right to left. The ram is in one piece with a loose clamping bar for quick changing of tongued dies.

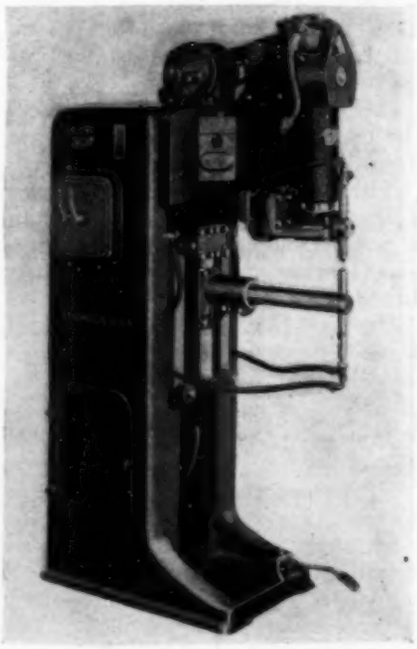
The bed is built of two plates with a 1½-in. standard spacing between plates. This spacing makes it possible to use the press for multiple punching with an inexpensive punching arrangement. The eccentric shaft is one-piece forged high-carbon steel, and friction clutch permits the machine to be stopped at any point on the up or down stroke. Both the flywheel and clutch are in one unit and run on Timken roller bearings. All shaft bearings are of phosphor bronze and are grooved for oil.

Adjustment of the ram is made by a handwheel in the front center of the press. Couplings can be disconnected to adjust each screw independently. Motor adjustment of the ram can be furnished if desired. Lubrication is made by a one-shot centralized system to all bearings. Machines are furnished for direct motor drive, either by gearing as illustrated, or V-belt drive. Four capacities are available; that is, lengths from 3 to 8 ft.



Thomson-Gibb No. 1 Press Welder

A medium-duty automatic spot and projection welder, known as the No. 1 press welder, has been placed on the market by the Thomson-Gibb Electric Welding Company, Bay City, Mich. The machine has a straight-spindle, press-type action, which adds to the life of the welding electrode. Flexibility in the design permits changing the strokes per minute and the speed of operation at any time by the addition of a few parts. All bearings are either Hyatt, Timken, or ball thrust.



The driving mechanism is mounted on top of the machine to reduce the floor space required and for accessibility. It consists of only two units —a motor and a worm reduction and clutch unit. Roller chain drive is employed. The transformer is water-cooled and gives sixteen variations

of welding heat. Welding pressures up to 900 lb. can be had. A pressure scale located in the head facilitates the recording of the correct pressure settings for all jobs

Speeds of 30 to 160 spots per min. are available. The machine can be furnished in either 12, 18, or 24-in. throat depths and may be powered with a 20, 30, or 40 kva. transformer.

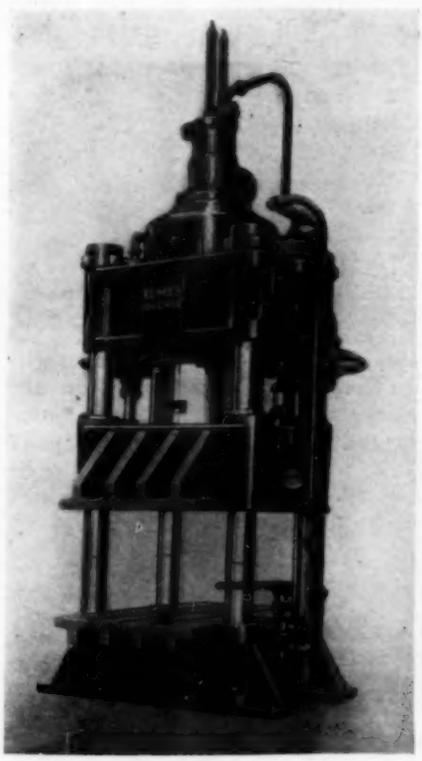
Elmes High-Speed Hydraulic Blanking, Forming and Straightening Press

Single lever control is featured in the heavy-duty, high speed blanking, forming and straightening press manufactured by the Charles F. Elmes Engineering Works, Morgan and Fulton Sts., Chicago. The press is heavily constructed throughout to reduce deflection to a minimum and to handle irregular shapes readily in both blanking and forming operations.

This high-speed type press is designed for a prefillng system and can be operated from a variable-delivery, single-direction pump of 60-gal. capacity and 1,500 lb. per sq.in. pressure. In the press illustrated, the idle down speed is approximately 200 in. per min., the pressing speed about 20 in. per min., and the return speed 190 in. per min. To secure accurate alignment and travel, the moving platen is equipped with renewable bronze guide bushings of extra length which serve as guides on the accurately located press columns. These columns are ground and polished. All major members of the press are annealed steel castings.

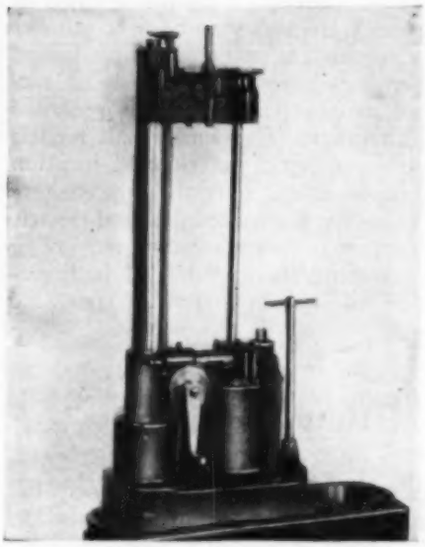
Control is by a 4-way, single-lever operating valve of the packless piston type. By moving the control lever to neutral, the press can be held in any desired position of its stroke. When the pump is idle, a special device holds the ram in up position and auxiliary control is arranged to shift the pump to no-discharge stroke when it is desired to hold pressure on the press without movement. As in other Elmes presses, compression-type ram packings are used which can be adjusted or renewed without dismantling the press rams.

The press illustrated is of 500-ton capacity with 32- to 42-in. adjustable opening and a 38 x 66-in. platen. Presses of this type can be built in sizes and capacities to suit requirements.



"Perfecto" Boring Bar for Cylinder Blocks

For reboring cylinder blocks, the Van Norman Machine Tool Company, Automotive Division, Springfield, Mass., is offering the "Perfecto" boring bar, which features high operating speed, accuracy and ease of operation. A single fly cutter tipped with tungsten carbide is employed and revolves at a speed of 250 r.p.m. The feeding rate down through the cylinder is at 1¾ in. per min., regardless of the diameter being bored. The cutting tool is mounted on a bar which revolves inside of another non-revolving bar. About ½ in. back of the cutting tool are four non-revolving expanding and contracting supports, which provide rigid support for the cutting tool throughout the length of the bore regardless of the conditions found. The result is a round, straight hole. The finish of the cylinder makes it possible to fit pistons immediately without recourse to the use of abrasives.

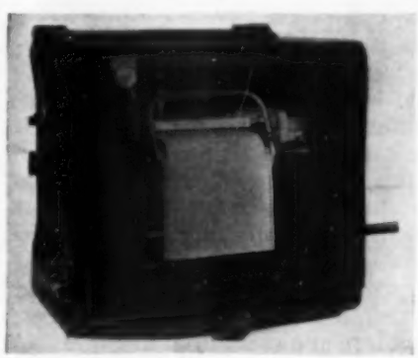


"Perfecto" Boring Bar

A special micrometer is furnished for the purpose of setting the cutting tools to the exact diameter of the cylinder desired. The toolholder is set in this micrometer and it is then pushed into the cutterhead. The range of the bar is from 2⅝ to 4½ in., inclusive.

"Tapalog" Improved Recording Pyrometer

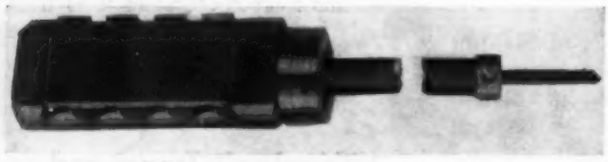
Recording pyrometers for single and multiple records, and of improved design, have been placed on the market by the Wilson-Maeulen Company, Inc., 383 Concord Avenue, New York, N. Y. These instruments, known under the trade name of "Tapalog", are operated entirely by an industrial type synchronous electric clock motor, which operates on a.c. circuits. The Tapalog, as now pre-



sented, provides a recording cycle of greater frequency and fewer number of mechanical parts. Multiple record Tapalogs have a faster cycle of record, so that each record is recorded with greater frequency. All models have automatic electric cold junction compensation. Recording pyrometers employing thermocouples, and electric resistance thermometers employing electric resistance bulbs, of both single- and multiple-record types, are now offered in this series.

Hutto "Revocipers"

Mechanical scraping of long bores can be done with the "Revocipers" announced by the Hutto Engineering Company, Inc., 515 Lycaste Ave., Detroit, Mich. The term "Revocipers" is derived from the revolving and reciprocating actions of the tool. The round-nosed blades are held in holders and set in soft metal. For diameters of 4.5 in. and over, the Revocipers are interchangeable with the abrasive holders in standard Hutto honing equipment, but for

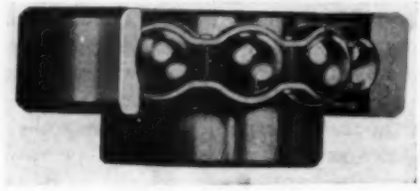


diameters less than 4.5 in. are mounted in a specially designed head, and are not interchangeable with the honing equipment.

The tool is specially adapted for use in honing machines for finishing bores in long tubing, bores in forged shafts such as hollow shafts, gun liners, rotor shafts, submersible motors and oil-feed shafts. They are not intended for rough boring, but are designed to remove excessive stock to prepare the bores for honing. Where only a true bore is required and commercial finished boring limits are acceptable, such as on ship propeller shafts, high-speed rotor shafts and locomotive axles, the honing operation may be eliminated. A high satin finish can be produced by permitting six complete reciprocations of the Revociper head after size is obtained, slightly reducing the traversing speed. The tools also are used to prepare for honing cold-drawn and seamless steel tubing, brass tubes, cast-iron and nickel-iron tubes, Monel metal tubes, Nitralloy liners and forged steel tubes with bore diameters from 1.625 to 10 in., and lengths up to 65 ft. Because of the application of Revocipers in expanding heads, the cut cannot exceed 0.002 in. in depth, the speed in stock removal being obtained from the revolutions and traversing speeds of the heads.

"Standard" Model SRB Wide-Inner-Ring Single-Row Ball Bearings

Standard Steel & Bearings, Inc., Plainville, Conn., announces the Type SRB wide-inner-ring single-row bearings of the same design and dimensions as the single-row maximum capacity bearings, except that the inner



ring has the same width as that of the double-row bearing of corresponding sizes. The additional width of the inner ring permits the bearing to be used without a lockout.

This type of bearing is offered for electric motors and other applications where only a locating or nominal thrust is present. It is available in Sizes 303 to 312, inclusive.

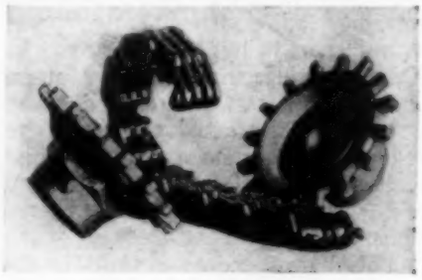
Starrett No. 150 Shallow Hacksaw Frame

The No. 150 hacksaw frame announced by L. S. Starrett Company, Athol, Mass., has a throat just deep enough to accommodate the blade. The result is that cuts can be made easily and quickly in spaces offering hardly more than 1 in. clearance. The frame has no tendency to wobble on shallow cuts of this kind, and the blades can be strained tighter with less danger of breakage. The cut can be made with one hand, with the other hand free to steady the work and turn it if necessary. The No. 150 hacksaw frame is fitted with the usual four-way blade adjustment.

Starret No. 150 Shallow Hacksaw Frame

Morse Midget Coupling

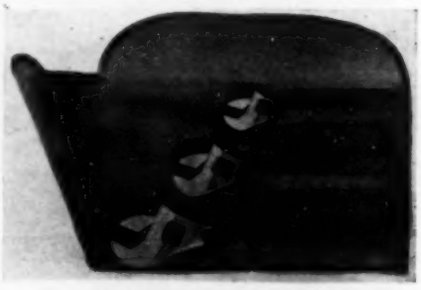
The "Midget" coupling, placed on the market by the Morse Chain Company, Ithaca, N. Y., is a miniature counterpart of the Morse chain-and-sprocket coupling on the market for



some time. The "Midget" likewise employs two sprockets wrapped by a chain. It is offered for shaft sizes up to 1 in. in diameter and is of all-steel construction.

"Crestoloy" Wrenches

Drop-forged wrenches of "Crestoloy" steel have been placed on the market by the Crescent Tool Company, Jamestown, N. Y. These wrenches will stand a strain of over



twice that required to break a regular Crescent wrench, but they are one-third thinner and are consequently lighter and easier to handle. The wrenches are offered in 6-, 8- and 10-in. sizes, having capacities for $\frac{3}{4}$-, $1\frac{5}{16}$-, and $1\frac{1}{8}$-in. nuts.

"Producto-Matic" No. 3½ Spiral Milling Machine

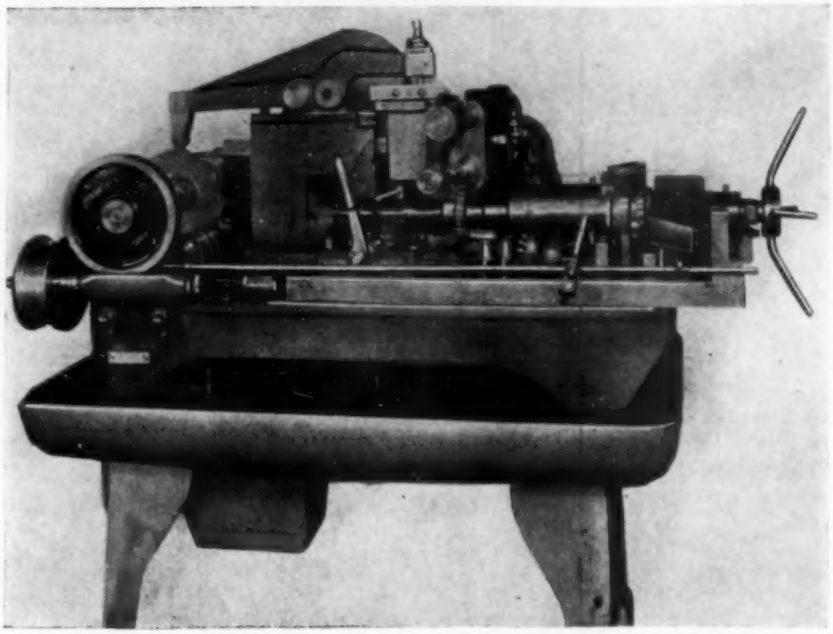


Fig. 1—"Producto-Matic" No. 3½ Spiral Milling Machine as seen from the front, showing the spindle ram in position for milling the spiral teeth in a 4-in. milling cutter

For milling spiral teeth in counterbores and milling cutters from ¼ to 6 in. in diameter, the Producto Machine Company, Bridgeport, Conn., has developed the No. 3½ spiral milling machine. This machine is entirely automatic, the feeding of the cutter, the return stroke of the ram and the indexing of the work being performed automatically. The cutter does not return through the work at the end of the stroke, but elevates clear of the work and returns to the starting point.

As shown in Fig. 2, the cutter spindle is driven by means of a worm and worm gear from a universal shaft, which allows the cutter block to be held at an angle while milling spiral work. This illustration also shows the master spiral cam. A sliding block is fitted alongside the cam and carries a roll that fits into the slot in the cam. This block is connected to the ram by means of a connecting rod, and as the cutter feeds forward the block is moved forward by the connecting rod, so that the roll turns the master spiral cam, which in turn revolves the index plate.

Production that can be obtained on a five-flute counterbore is 18 pieces per hour and the production on spiral-tooth milling cutters of 4 in. in diameter, 22 teeth, is 5 pieces per hour. The cutters run at 8 r.p.m. and 0.4-in. feed.

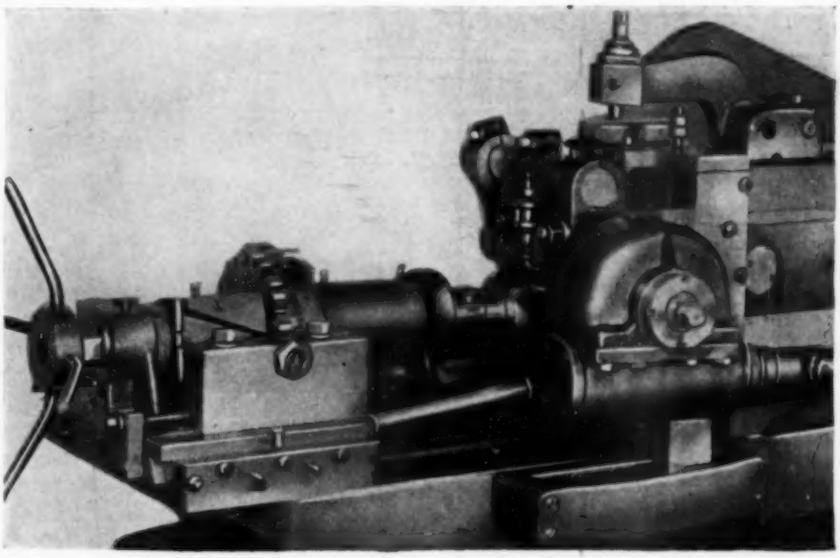


Fig. 2—Close-up of the worm drive for the cutter spindle, the indexing mechanism, and the master cam

"YPS" Aluminum Skid Platforms

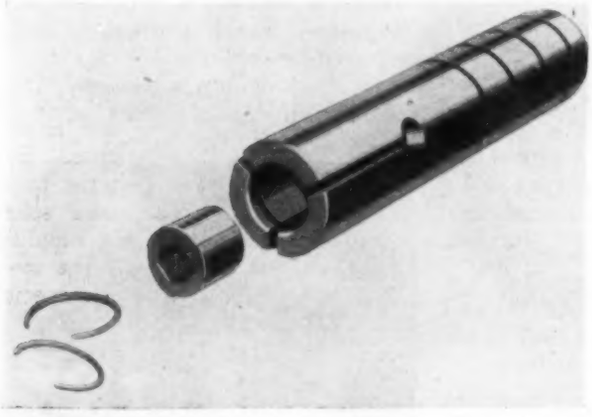
Aluminum skid platforms, both acid and corrosion-resistant, have been placed on the market by The Youngstown Pressed Steel Company, Warren, Ohio. They have been developed in conjunction with engineers of the Aluminum Company of America. The photograph illustrates a skid 36x52x12 in., which weighs 65 lb. Under test this skid platform carried a safe load of 8,200 lb. without signs of damage.

Not a Herculean task

A one-hand lift of an aluminum skid platform

Producto Removable Leader Pin for Die Sets

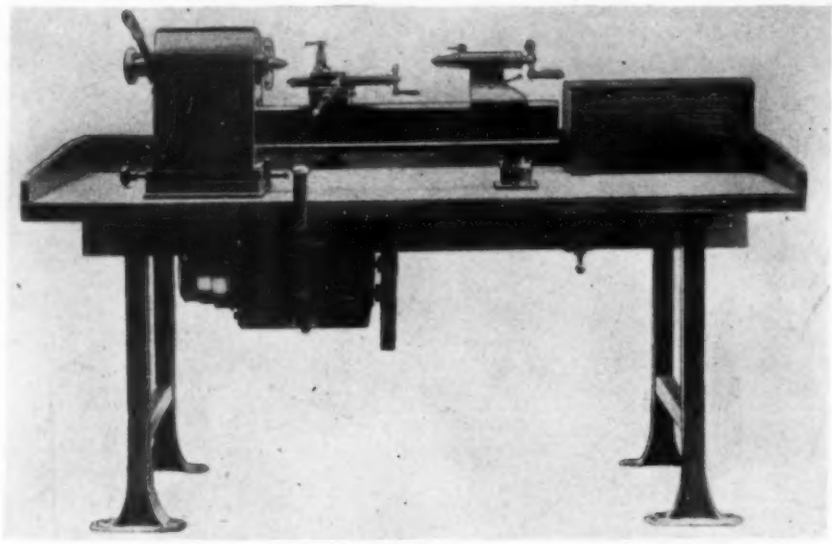
Since the users of die sets find it desirable to have removable leader pins to facilitate taking down the die set for regrinding of the dies, the Producto Machine Company, Bridgeport, Conn., is now manufacturing the removable leader pin illustrated. The pin is straight, but it is slit at one end to accommodate the expanding locking member. This member is held in place by the two circular springs illustrated. The three-lobe cam is generated, each rise having a height of 1/64-in. A complete turn on the cam by means of a socket-head wrench gives an expansion of 0.008 in. on the pin, which is sufficient to lock the pin in place even in worn die sets.



The removable leader pin is made in diameters from $\frac{7}{8}$ to 2 in., and in lengths from 4 to 10 in. Pins may be supplied on all Producto die sets.

Rivett Improved Series 505 Lathes

Several improvements have been made in the Series 505 ball-bearing headstock lathe manufactured by the Rivett Lathe & Grinder Corporation, Brighton, Boston, Mass. This lathe was originally offered for use with tungsten-carbide tools (*A.M.*—page 225, Vol. 74), and featured a maximum spindle speed of 4600 r.p.m. It is now offered with an inclosed headstock and mounted on a bench with jack pedestals. The speedbox motor drive is swung below and controlled by a hand lever. In addition to the ball-bearing headstock for tungsten-carbide tools, four plain-bearing headstocks from $\frac{5}{8}$- to $1\frac{1}{8}$-in. collet capacities are now available. Belt shifting is effected by means of the rod and knob on the left-hand side of the headstock enclosure. Six speeds forward and six speeds in reverse (with the reversing switch) are obtainable from the operator's position. For oiling the headstock a small removable cover plate at the rear is now provided. A slot in the rear section gives access to the headstock jack pedestal for height adjustment of the lathe to maintain correct belt tension. The rear section of the head is removable to gain access for adjustment of spindle bearings.



Rivett Series 505 Lathe with inclosed headstock and underneath speedbox motor drive

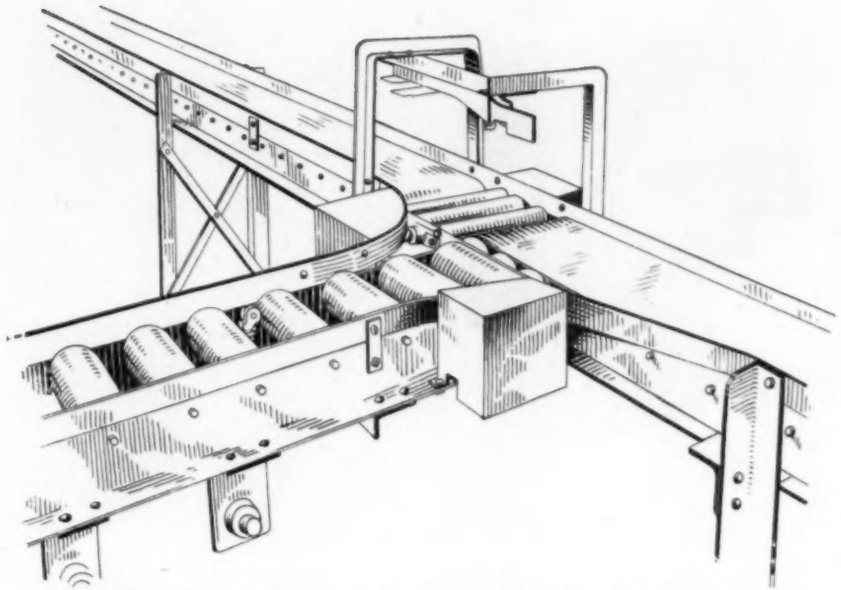
"Wyco" Universal Speed Saw

A sawing and filing attachment for use with a portable electric drill is being marketed by Wyzenbeek and Staff, Inc., 566 Washington Blvd., Chicago. This device may also be applied to a flexible shaft unit. Saws are provided for cutting both wood and metal, or the unit can be used with $\frac{1}{4}$-in. square or round files. A standard $\frac{1}{4}$-in. electric drill provides ample power for the saw.

Rotary motion of the drill shank is converted into reciprocating motion of the saw blade through a cylindrical, grooved cam and a hardened steel roller follower. The reciprocating saw plunger runs in grease lubricated bronze bearings. The entire mechanism is inclosed in a cadmium-plated knurled housing, which is grasped in the hand. This outfit includes a complete sawing unit, five additional saw blades and a $\frac{1}{4}$-in. chuck for holding files.

"Standard" Selective Diverter for Conveyors

A selective diverter permitting deflection of products to any number of lateral lines from one main conveyor has been developed by the Standard Conveyor Company, North St. Paul, Minn. The tote boxes carrying the product are provided with a series of buttons on the forward edge. Pulling up the proper button will automatically cause the tote box to be selected at the proper lateral line and diverted from the main conveyor. The raised button makes contact with the selecting mechanism shown in the accompanying illustration and is swung so that it engages with the lateral con-

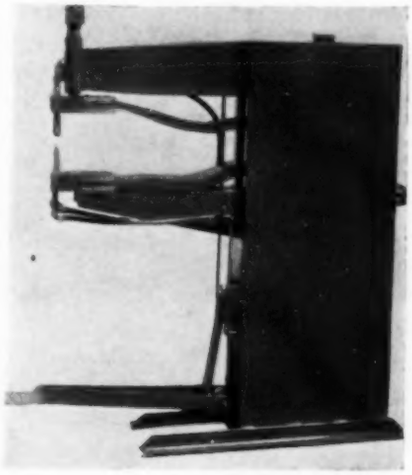


This "Standard" Selective Diverter Mechanism is positioned laterally to make contact with a button on the tote box and swing it into the lateral channel

veyor line. A special feature of this automatic diverter is that jamming is prevented in the event of one of the lateral lines being filled. In this case the tote box continues on the main conveyor. The selecting mechanism is positioned laterally to make proper contact with the tote-box button.

"Electroweld" Resistance Welders

Arc-welded resistance welders in two sizes have been developed by the Electric Arc Cutting & Welding Company, 152 Jelliff Ave., Newark, N. J.

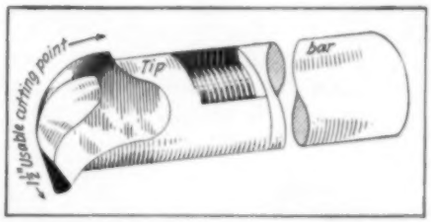


The type R welder is of 15 kw. capacity and the type J of 20 kw. capacity. The smaller machine has heat control at the top of the casing. The welding tips move in a straight line and are pedal-controlled. Capacity is two thicknesses of 18 gage, and throat depth is 12 in.

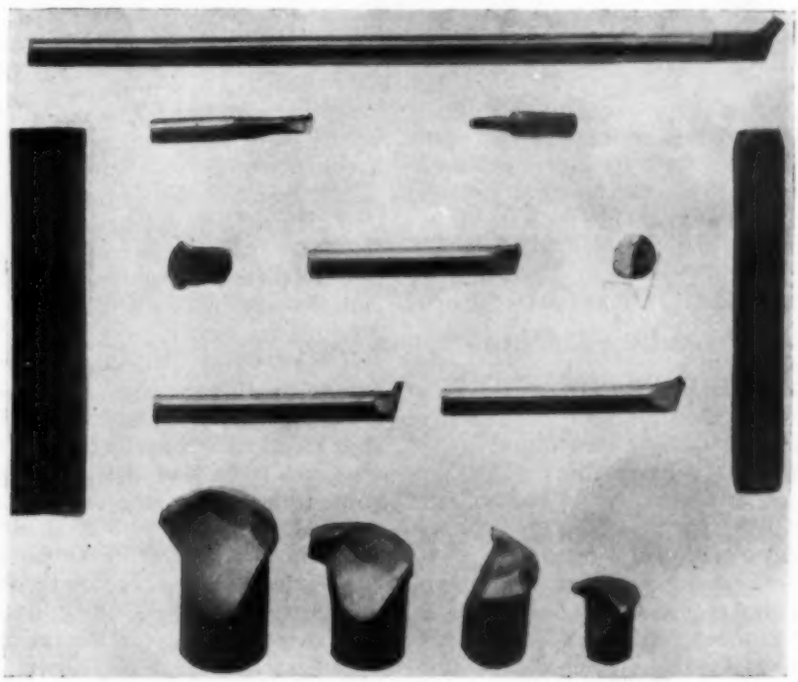
The type J machine has alligator motion for the tips, which are water-cooled. Knife switches, when in the closed position, have no exposed parts, and there are three steps for heat regulation. Capacity of this unit is two thicknesses of No. 6 gage, and the throat depth is 24 in.

Fanger Internal Boring, Facing, and Threading Tools

Considerable regrinding can be done on the Fanger internal boring, facing, and threading tools announced by the Bochum Tool Company, P.O. Box 32, Northwestern Station, Detroit, Mich. The special circular form of these tools enables them to be reground quickly or to be touched up while there is any form left on the circumference. All tools of 0.472 in. in diameter and upwards have a cutter diameter equal to the diameter



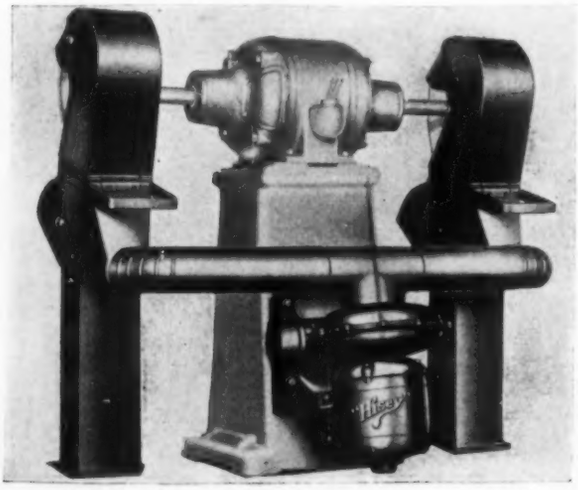
of the bar, and are bored and threaded to screw on the bar. At the end of its useful life, the cutter can be unscrewed and a new one mounted. Below 0.472 in. in diameter, the tools are made in one piece, and split-spring clamping blocks are supplied to fit these when required. The steel employed for these tools is a special 22-per cent tungsten alloy steel.



Representative Fanger Internal Boring, Facing, and Threading Tools of both the removable-tip and solid types

Hisey-Wolf Exhauster Equipment for Buffing and Polishing Machines

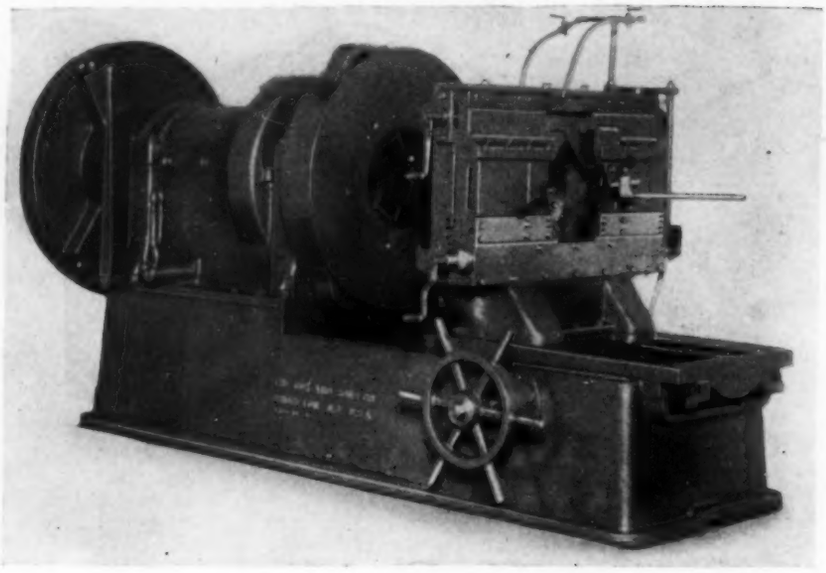
A motor-driven exhauster blower for use with its buffing and polishing equipment has been announced by The Hisey-Wolf Machine Company, Cincinnati, Ohio. This blower is mounted integral with the machine as shown, and the same automatic motor starter simultaneously controls both motor units. The equipment also includes a dust-collecting hood as shown. It is supplied for all sizes of buffing and polishing machines from ½ to 5-hp. inclusive. It is also supplied for floor-stand grinders of 10, 12 and 14-in. wheel capacity, the equipment also including the combination exhaust guards.



A filter cabinet, not shown, is particularly adapted for individual installations. This unit collects grit and dust and occupies but little space.

Cox 12-In. Pipe-Cutting and Threading Machine

A 12-in. pipe-cutting and threading machine, arranged for either belt or motor drive, has been placed on the market by The Cox and Sons Company, Bridgeton, N. J. The bed is of the box type to eliminate vibration, and the section under the cutting head has a closed bottom cast integral with the bed for catching chips and oil from the threading operation. The bottom of this container is inclined toward the end of the machine to facilitate removal of chips.



Cox 12-In. Pipe-Cutting and Threading Machine, which has the threading dieheads carried on sliding members to float with the pipe

The machine is equipped with an independent 3-jaw gripping chuck at both the front and rear end of the spindle, and with auxiliary flange grips on the rear chuck. The cutting head is rigidly mounted on the carriage, and the cutting-off attachment is equipped with two high-speed steel cutter knives and steady gibs for supporting the pipe during the cutting operation. A calibrated gage attachment indicates the length of thread to be cut.

The threading dieheads are carried in sliding rails on the face of the cutting head and are not held in a fixed position, thus allowing the die to float with the pipe. Nine spindle speeds are obtained through the gearbox at the rear. Gears are of hardened steel and run in oil. The shafts are equipped with Timken roller bearings. Gear shift levers extend to the front of the machine, as well as the gear clutch lever, to be within easy reach of the operator.

The motor is attached to the bed and connected to the gearbox by silent gear drive. Reversing motor control is located at the front of the machine. When arranged for belt drive, the pulley is attached to the constant-speed driveshaft on the gearbox and is operated by a reversing countershaft. A pressure oil pump and piping system for delivery of oil from the bed to the dies and cutter knife are fitted.

Approximate weight of the machine is 11,200 lb., and the floor space required is 5 ft. 6 in. by 10 ft.

Wiss "Nu-Grip" Snips

Regular pattern and combination pattern snips for sheet-metal work have been placed on the market by J. Wiss & Sons Company, 33 Littleton Avenue, Newark, N. J. These "Nu-Grip" snips are made in Types U-7 and U-8½ regular pattern for straight work and the Type UC-8 combination pattern for curved, irregular, and straight work. The regular pattern snips are 7 and 8½ in. long, respectively, and the combination

Wiss "Nu-Grip" Snip of the regular pattern for straight work

Wiss Type UC-8 Combination Pattern Snip for curved, irregular and straight work

pattern snips, 8 in. All types are made of crucible tool steel, hardened and tempered and fitted with a hardened bolt and nut. The combination pattern is designed for cutting curves, circles, and irregular jobs such as templets, fixtures, and pattern work, but in addition can be used for straight cutting.

PATENTS

JUNE 9, 1931

Metal-Working Machinery

Rotary Cutting Operations and Apparatus Therefor. John J. Buckley, Chester, Pa. Patent 1,809,019.

Machine for Forming Electrical Heating Elements. Edwin L. Wiegand, Pittsburgh, Pa. Patent 1,809,090.

Plating-Machine Automatic Workshift. Constantine G. Miller, Chicago, Ill., assigned to The Meaker Co. Patent 1,809,136.

Apparatus for Covering Rolls with Toothed Wire. James A. Noonan, Lowell, Mass., assigned to C. G. Sargent's Sons Corporation. Patent 1,809,144.

Horizontal Boring and Tapping Machine. John S. Barnes, Rockford, Ill., assigned to W. F. and John Barnes Co. Patent 1,809,188.

Board Drop Hammer. Harry G. Kimball, Bronxville, N. Y., assigned to The Billings & Spencer Co. Patent 1,809,300.

Method of and Machine for Relieving Cutters. John Edgar, Rockford, Ill., assigned to Barber-Colman Co. Patent 1,809,377.

Relieving Device for High Speed Drills. Frank L. Cone, Windsor, Vt. Patent 1,809,402.

Apparatus for Finishing Bearings and Bushings. Thomas David Bowes, Cynwyd, Pa. Patent 1,809,545.

Centrifugal Casting Machine. James B. Ladd, Ardmore, Pa., assigned to United States Cast Iron Pipe & Foundry Co. Patent 1,809,631.

Automatic Arc Welding Machine. Paul Wagner, Charlottenburg and Sally Sandelowsky, Berlin-Grunewald, Germany, assigned to General Electric Co. Patent 1,809,653.

Flying Shear. Bruce N. Bletso, East Cleveland and George H. Rose, Cleveland Heights, Ohio. Patent 1,809,668.

Drop Hammer. Frank J. Vichek, Cleveland, Ohio, assigned to The Vichek Tool Co. Patent 1,809,805.

Tools and Attachments

Apparatus for Plating. Dwight T. Ewing, East Lansing, Mich. Patent 1,808,809.

Screw Thread Testing Device. Charles G. Johnson, Hartford, Conn., assigned to Pratt & Whitney Co. Patent 1,808,816.

Percussive Hand Tool. Louis Fluhr and Anthony Verhaar, Brussels, Belgium. Patent 1,808,948.

Cutting Torch. Stuart Plumley, Minneapolis, Minn., assigned to Smith Welding Equipment Corporation. Patents 1,808,967 and 1,080,968.

Metal-Working Tool for Rolling Fenders. Herman W. Johnson, St. Louis, Mo., assigned to Stiles-Herman Manufacturing Co. Patent 1,809,126.

Tool for Upsetting or Stretching Sheet Metal. Hugo Junkers, Dessau, Germany. Patent 1,809,168.

Commutator Mica Undercutting Tool. Walter T. Ballou, Los Angeles, Calif. Patent 1,809,228.

Broach Holder or Adapter. Carl J. Halborg, Detroit, Mich., assigned to Colonial Tool Co. Patent 1,809,237.

Swinging Die Holder for Fastener Setting Machines. Frank E. Warner, Waterbury, Conn., assigned to Scovill Manufacturing Co. Patent 1,809,322.

Electrical Metal Welding. Emilien Bornand and Hans Arnold Schlaepfer, Geneva, Switzerland. Patent 1,809,468.

Indicator Mechanism. William C. Moran, Laurel Springs, N. J., assigned to Riehlé Bros. Testing Machine Co. Patent 1,809,525.

Gage Device. Ottis R. Briney, Pontiac, Mich. Patent 1,809,547.

Tool Holder. Hermann M. Graul, Detroit, Mich.; Edith P. Graul administratrix of said Hermann M. Graul, deceased. Patent 1,809,553.

Safety Device for Hydraulic Presses. Frank C. Wilson, Arcade, N. Y. Patent 1,809,615.

Furnaces

Rotary Valve Furnace. Wilbur E. Sanders, Muncie, Ind., assigned to General Motors Corporation. Patent 1,809,727.

TRADE PUBLICATIONS

BALL BEARINGS. The Aetna Ball Bearing Manufacturing Co., 4600 Schubert Ave., Chicago, Ill., has issued a 68-page book entitled "Ball and Roller Bearings—A Handbook for Designers and Engineers," illustrating the ball thrust and radial roller bearings manufactured. Other items are listed, and complete design data are included.

CAR SPOTTERS. H. W. Caldwell & Son Co., 2410 W. 18th St., Chicago, has issued book No. 1292, pointing out the important features of car spotters, and giving complete dimensions, capacities, horsepowers and speeds. A chart for figuring the degree of curvature of railroad tracks and actual pull on the car spotter rope is included.

CHAIN SLINGS. The Newhall Chain Forge & Iron Co., 9-15 Park Place, New York, N. Y., has issued a pamphlet on heavy-duty sling chains and sling parts.

CLUTCHES, MAGNETIC. Cutler-Hammer, Inc., 12th & St. Paul Aves., Milwaukee, Wis., has issued a booklet "Keeping Pace with Machine Design," which deals with the construction, operation and application of "C-H" magnetic clutches and includes a full description of the new Duplex clutch.

CUTTING OILS. The National Safety Council, Inc., 20 N. Wacker Drive, Chicago, has published a revised edition of the Safe Practices Pamphlet No. 44 on the safe use of cutting oils and emulsions. A large part of the eight-page booklet is devoted to skin troubles and their prevention. Scale drawings of sterilization apparatus are included for practical application.

DEALER RELATIONSHIPS. The Policyholders' Service Bureau of the Metropolitan Life Insurance Co., One Madison Ave., New York, N. Y., has issued "Making the Dealer an Adviser," giving the experience of large companies in an organized cooperative relationship.

MOTORS. The Reliance Electric & Engineering Co., Ivanhoe Road, Cleveland, Ohio, has published bulletin No. 209 on the Type T, heavy-duty motors for d.c. applications.

REAMERS. The Goddard & Goddard Co., Detroit, Mich., has issued Bulletin No. 103, dated May 1, 1931, on the cam lock reamer. The various types are illustrated and the specifications are listed.

DIE SET CHART. The Danly Machine Specialties, Inc., Chicago, Ill., has published a condensed chart by means of which it is possible to choose any one of 20 sizes and six different thickness combinations of the most popular types of die sets used for square, rectangular and round dies. This chart measures 17x11 in., and 1,400 different combinations can be worked out.

TOOLS. The Eclipse Counterbore Co., 7410-30 St. Aubin Ave., Detroit, Mich., has issued Catalog No. 32 as of May, 1931, comprising 112 9x6 in. pages on counterbores, spot facers, two-piece core drills, and cutters of various designs. The catalog is unusually well illustrated with photographs of the tools and production set-ups. Complete information and specifications are given on each type of tool.

TUNGSTEN CARBIDE MILLING. Kearney & Trecker Corporation, Milwaukee, Wis., has published a 24-page bulletin on the latest developments in faster milling with tungsten and tantalum carbide. It includes the paper recently presented by Frank W. Curtis at the S.A.E. production meeting at Milwaukee, as well as photographs and data on the demonstrations given at the K. & T. plant during the same meeting.

American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

New York, June 18, 1931

VOL. 74 NO. 25

Wanted—a Formula

QUIETLY, competently and with minimum lost motion, Prof. F. E. Raymond of Massachusetts Institute of Technology is proceeding with a most important research project under the auspices of the A.S.M.E. and the A.S.A. It is no exaggeration to say that the eyes of every executive and engineer in industry are upon him, for his task is to develop a universally acceptable "replacement formula." Those who have attempted the same task will understand the difficulties inherent in determining mathematically when new machinery and equipment should replace old for maximum economy and profit.

Prof. Raymond desires and needs the co-operation of everyone who has definite ideas to contribute. Immediate response is urged that his work be not delayed. Many a manufacturer would give his right hand to have the formula right now.

Up to the Sellers

WITH commendable spirit the National Foreign Trade Council is distributing the final declaration of its eighteenth national convention. "Stop Profitless Merchandising," it says. "The most significant fact in the status of international trade of the world is that the volume of merchandise sales about equals that of a few years ago when business was enjoying substantial prosperity. But price levels have fallen to a point where profit has been largely eliminated. . . . An essential necessity of the present economic situation is an advance in commodity prices . . . It is rising prices that stimulate buying . . .

"The importance of fair prices cannot be overestimated in influencing the restoration of trade. Sellers cannot expect to obtain fair prices for their own products unless as buyers they are willing to pay fair prices. . . ."

All true, as far as the declaration goes, but some of us are so worldly as to doubt that any buyer will be led to pay more than the market price for any commodity. "Stop Profitless Merchandising" is not likely to be any more effective as a slogan than "Buy Now" or "Conditions Are Fundamentally Sound."

After all, is not much of the onus for falling prices to be found in the timidity and hesitancy of sellers themselves? Manufacturer after manufacturer has reported his inability to place reasonably long-time commitments at current prices. Sellers do not seem to realize that the acceptance of one or two such orders from well-known and highly regarded buyers would serve as pegs to stop further price declines and as entering wedges to more orders from other buyers. It seems unjust to condemn buyers for hand-to-mouth buying at the lowest prices they can get when sellers are encouraging them in the practice.

Security

A GROUP of salaried employees lost their jobs recently, and without a day's warning. Some of them had been with the company more than fifteen years.

Five or ten years ago an action like this one would not have caused very much comment; modern ideas on personnel policies had not then been generally accepted. But today it comes as a shock to our sense of what is fair and right, particularly so if one has just been reading of citations made to companies that have been outstandingly successful in their methods of handling employees in slack periods.

Quite aside from the fairness of such a procedure there is the effect of it upon the men involved and upon other employees to be considered. Of course the men cut off are immediately eliminated from the consumers of anything beyond the bare necessities. But the others promptly take fright and scale down their purchases to be prepared as well as possible if a similar fate overtakes them.

No company should be so poorly managed that it cannot say positively to its salaried employees that they will be given at least sixty days' notice before being dropped. Such a statement would give a feeling of security that would help immensely to stimulate buying and to hasten the revival of business.

NEWS OF THE WEEK

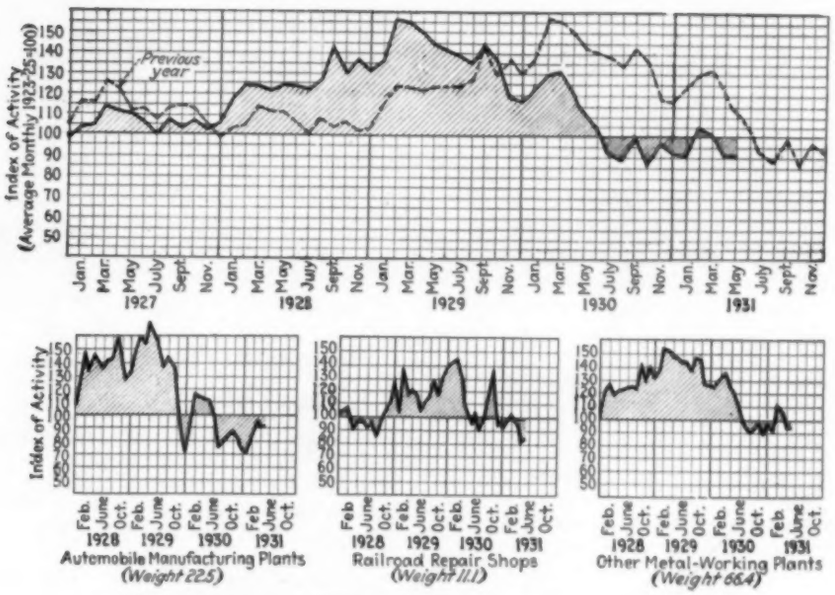
Soviet Planning To Be Described

Soviet Russia's experience with economic planning will be told officially at an international meeting for the first time at the World Industrial Relations Congress in Amsterdam, Holland, the week of Aug. 23, according to a recent announcement by Mary van Kleeck, vice-president of the International Industrial Relations Association.

Machine Tool Men Lead Cincinnati A.S.M.E.

Members of machine tool and machinery manufacturing plants of Cincinnati are prominently engaged in directing the activities of the local section of the A.S.M.E. R. E. W. Harrison, chief engineer, Cincinnati Grinders, Inc., has been re-elected chairman of the Cincinnati Section for 1931-32 season. Other members of the Executive Committee associated with the machinery builders include: H. C. Uihlein, Cincinnati Engineering Tool Co.; Wm. F. Groene, R. K. LeBlond Machine Tool Co.; George Seyler, Lunkenheimer Co.; George Langen, Cincinnati Planer Co.; C. L. Koehler, Alvey-Ferguson Co.; Wm. H. Vockell, Cincinnati Engineering Tool Co., and Harry Feldbush, Worthington Pump & Machinery Corporation.

R. E. W. HARRISON



May Metal-Working Operations Show Slowing of Decline

A SLOWING up of the decline which has marked our industrial activity during the past several months is indicated by reports on the consumption of electrical energy for power purposes. The final figure of 105.7 in February, 100.3 in March and 92.4 in April rises to 92.6 in May. These figures and subsequent ones are corrected for 26 working days.

The automobile shop index, given as 72.9 for January, 88.9 for February, 94.1 for March and 90.8 in April, increased to 91.5 in May. The railroad repair shop index for January of 95.6, for February of 102.1, for March of 94.3 and for 82.8 in April, increased to 84.7 in May. Ferrous and non-ferrous metal-working plants outside these two groups have a May index of 94.1, a slight decline from 94.6 in April. Other figures include those for March of 103.5, for February of 112.2, for January of 92.9, and for December, 97.8.

When the figures are adjusted seasonally, slight revisions occur. The railroad repair shop index drops from 84.7 to 82.5, as compared with 80.1 in April, 90.3 in March, and 90 in February. The automobile figure drops from 91.5 to 78, as compared with 76 in April, 88.2 in March, and 85.3 in February. The "other metal-working" figure drops from 94.1 to 91.7, as compared with 92.4 in April, 95.3 in March and 100.7 in February. These give a seasonally adjusted figure for the entire group of 87.3, as compared with 87.9 in April, 92.9 in March, 95.9 in February.

Behr-Manning and Norton Merge

Announcement has just been made of a plan for the consolidation of the Norton Co., Worcester, Mass., and the Behr-Manning Corporation, Troy, N. Y. The merger will be made through exchange of stock, exact details of which have not been made public. The Norton Co. was founded in 1885 for the making of emery grinding wheels and now does a world-wide business in the manufacture of grinding wheels, grinding machines, refractories, non-slip floors and crystalline abrasives, with plants in this country, Canada, Germany, France and England. Behr-Manning, founded in 1874, has been a leader in the development of abrasive papers and cloths for machine and technical uses.

Plans for the consolidation call for the continued operation of the two merging companies under their present names, and managements, and with their present manufacturing and sales organizations. It is expected that John A. Manning, president, and Frank E. Gallagher, general manager, of the Behr-Manning Corporation, will be included on the present board of directors of the Norton Co., while Aldus C. Higgins, treasurer, and W. LaCoste Neilson, vice-president of the Norton Co., will take places on the Behr-Manning Corporation board.

The different lines of abrasive products of these companies are in great measure supplementary, so the proposed consolidation will constitute a well integrated business covering the entire abrasive field.

The plan calls for a change in the capital stock structure of the Norton Co., so that it may serve as a holding company for the two merging units, with an authorized capital stock of 2,300,000 shares of $10 par value, of which 2,231,513 shares will be issued.

AN OPEN competitive examination for foundry superintendent has been announced by the United States Civil Service Commission. Applications must be on file not later than July 21.

Industries Using Trade Practice Rules Abandon Efforts to Obtain Revisions

PAUL WOOTON
Washington Correspondent

WASHINGTON, D. C., June 15—Impressed with the futility of further remonstrance, industries operating under trade practice rules decided last week to abandon as a group all attempts to obtain from the Federal Trade Commission a satisfactory revision of their codes. Eighty codes, revised by the Commission during the spring, were returned last week to the industries with an ultimatum either to accept or reject them within sixty days.

Acting individually, industries whose codes, as revised, still retain desired provisions, will accept the revision. The others will ignore the Commission in the future and either lay their case before the Department of Justice or let their own judgment be the guide to their conduct.

Criticism of the Commission's revision of the trade practice codes centers on the deletion of rules that have long been recognized either in the law or the courts. A striking example of such an omission is the rule, previously incorporated in many codes with the Commission's approval, which recognizes the use of a base price list. The quotation of current prices as so much off list has been customary in many lines of business for several generations. The Commission also struck out other rules which, in specific terms, disclosed their purpose to prevent price discrimination as defined in the Clayton Act. One such rule condemned any departure from terms and discounts that would result in discrimination as between customers of the same class or buying in the same quantities. In the deletion of another rule the Commission denies that there is any discrimination in the sale to some customers of less than carload lots of merchandise at car lot prices.

By striking out a rule providing that a firm shall quote only a single bid on each job the Commission refuses to permit adoption by industry of the same high standard as the government insists upon in its contracts.

Cuban Tariff Reduced By Presidential Decree

Cuban Presidential Decree No. 739, promulgated June 3, provides for a reduction of $\frac{1}{10}$ of the regular import duty on industrial machinery when imported for the establishment of new industries. Industrial machinery regularly is subject to duty at the rate of 8 per cent and 9 per cent ad valorem, depending upon whether or not copper or its alloys predominate as the component of greatest value, which rates are now reduced to 2.4 per cent and 2.7 per cent ad valorem when the machinery is imported for the establishment of new industries.

Chicagoans Visit Oakley Colony

Members of the Chicago Superintendents & Foremen's Club were visitors at the Oakley machine tool Colony in Cincinnati on June 6. The hosts were the Cincinnati Chamber of Commerce, the Cincinnati Milling Machine Co., and Cincinnati Grinders, Inc., and their foundries. More than 250 men were included in the group which visited the plants. On June 7 more than 1,500 employees of the milling machine co. and their families viewed the exposition of machine tools and ultra-accurate measuring devices which had been set up for the visitors.

CLASS I railroads of the United States for the first four months of 1931 had a net railway operating income of $146,136,775, which was at the annual rate of return of 2.11 per cent on property investment, according to reports just filed by the carriers with the Bureau of Railway Economics. In the first four months of 1930, their net railway operating income was $238,805,095, or 3.51 per cent on the property investment. Gross operating revenues for the first four months of 1931 totaled $1,448,260,061, compared with $1,783,685,089 for the same period in 1930, a decrease of 18.8 per cent. Operating expenses meanwhile decreased 17.2 per cent.

SIMPLIFIED Practice Recommendation R28-29 on Sheet Steel has been reaffirmed by the Standing Committee without change for the ensuing year.

Foremen Stress Practice, Not Preaching

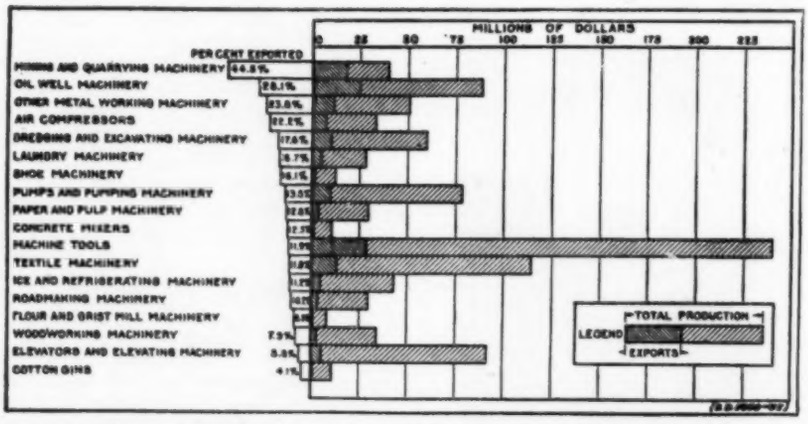
The eighth annual convention of the National Association of Foremen, held at Dayton, Ohio on June 12 and 13, served to emphasize the increasing growth of this organization. Starting as a local organization ten years ago, it now has 5,500 members, of whom 700 attended the convention. The internal organization of the society includes 17 city-wide foremen's associations and 35 shop clubs; the rest of the membership are groups and individuals from many plants.

Headed and directed by practical shop men, it was to be expected that the program presented would be radical both in character and presentation. There was no preaching, no theory. The conference method of presentation was used throughout. Delegates happily lacking the professional restraint of members, some of more learned associations, took an active part in the discussion and questioned every doubtful or obscure statement. It was no place for "bunk".

The underlying theme of the convention, and unconsciously so, probably, was professional ethics. In fact, the subjects presented could not have been discussed with the freedom they were without impressing the foremen that the object of management was the clarify conditions, not befog them. "Overhead" was stripped of its cloak of mystery and made understandable, and cleanliness was made attractive.

The greatest sales resistance encountered by the Foremen's Association movement is among those companies that think their "business is different." There was not a paper or discussion on the program that was not just as pertinent to the foundry foreman as it was to the machine foremen.

The only "danger" an observer can see in the movement is that some of the foremen are in danger of acquiring a more practical and comprehensive knowledge of management than their employers. To prevent any such catastrophe, one session was devoted to informing the higher executive what might be expected from foremanship development.



Proportions of production of certain classes of industrial machinery exported in 1929. 11.9 per cent of machine tool production was for export

Machine Exhibits At Chicago Fair

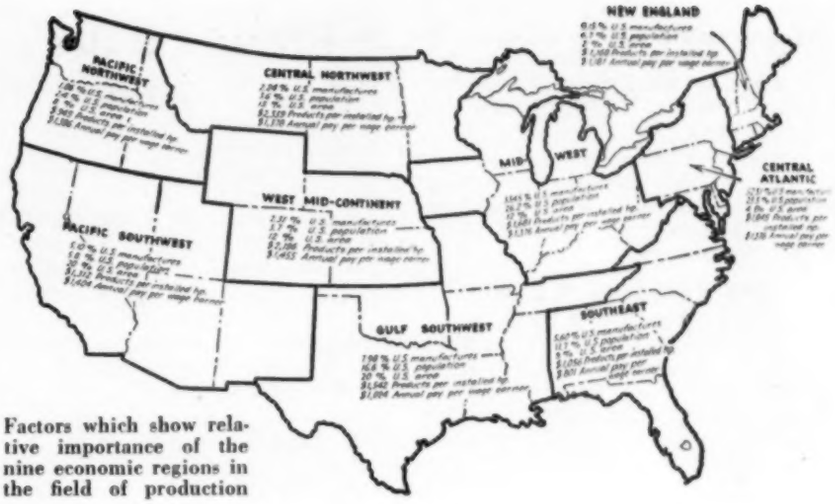
Machinery exhibits at A Century of Progress International Exposition, Chicago, 1933, will be so displayed that visitors will see the machine as the benefactor of mankind. The exposition management has under consideration plans for a mechanical engineering display contained in a report of the mechanical engineering division of the National Research Council Science Advisory Committee which favors an historical portrayal of the development of prime movers of various kinds, the increasing use of power by mankind, and the corresponding increase in wealth and comforts which have accompanied such increased use. The report recommends that the exhibits be largely composed of models, either full-sized or in miniature, with charts, diagrams, moving pictures and explanatory placards, indicating the various scientific principles involved. Other suggested exhibits include early types of the steam engine, a full-size model of a Corliss engine, and by the side of it a modern steam turbine, less than one-tenth the weight of the Corliss engine and capable of doing an equal amount of work with half as much steam. Exhibits showing the development of the internal combustion engine are also recommended. These would begin with the Otto gas engine and go on up to the Diesel. Models of the Rider and Ericsson hot-air engines, and a solar engine are also suggested.

Polakov Honored by A.M.A. Directors

Walter N. Polakov, who has just returned from two years service as consulting management engineer to the Russian Supreme Economic Council, was the guest of honor at a private dinner given by the directors of the American Management Association, at the Hotel Astor, New York, June 11. He was introduced by W. J. Graham, president of the association. Mr. Polakov states that he is not contemplating a return to Russia and that he has opened offices at 25 Fifth Ave., New York City.

DIVIDENDS paid by manufacturers of machinery in May, amounted to $2,950,581, according to the Standard Statistics Co., New York. Total cash dividend payments made by domestic corporations in May were $229,608,425.

A MARBLE bust of Thomas A. Edison was unveiled in the Hall of Honor of the Deutsches Museum, Munich, during May. The bust, jointly sponsored by the Edison Pioneers and the American Institute of Electrical Engineers, was bestowed at the time of the museum's annual meeting. The Edison bust is one of two accorded a position in the museum hall.



Factors which show relative importance of the nine economic regions in the field of production

BUSINESS ITEMS

The entire land, buildings, machinery and equipment, tools, dies, fixtures, etc., of the Universal Machine Co. plant at Bowling Green, Ohio, of the Superior Universal Products Co., Lima, Ohio, will be sold at public auction on June 25 by order of the stockholders. Since the plant will not be offered as a whole, this will mark the cessation of the manufacturing activities of one of the largest former producers of universal joints in the country. The sale will be handled by the Industrial Plants Corporation (of Ohio), Columbian Building, Columbus, Ohio.

Manning, Maxwell & Moore, Inc., 100 East 42nd St., New York, N. Y., will continue the manufacture of Shaw overhead electric traveling cranes at Muskegon, Mich., and the direct sales office for the Chicago territory is now located at 80 East Jackson Blvd. The sale of Putnam machine tools in the Chicago territory will be handled by the Dean Machinery Co., also at 80 East Jackson Blvd., as announced in the *American Machinist* for May 14, page 778.

The Monarch Machine Tool Co., Sidney, Ohio, has opened a Chicago office at 547 West Washington Blvd., under the personal charge of Martin J. Luther.

Merger plans of the City Machine & Tool Co. and the City Auto Stamping Co., both of Toledo, Ohio, will be submitted to stockholders of both companies at special meetings to be held on June 24. The plan as approved by the directors of both companies provides that the merger is to become effective on July 1, and the combined company is to be known as the City Auto Stamping Co.

The plant of the Winchester Repeating Arms Co., New Haven, Conn., will be kept in operation despite the recent foreclosure of the $5,500,000 mortgage.

Murex Welding Processes, Ltd., London, England, is beginning negotiations for the formation of a subsidiary company in the United States. As the result, a new company has been formed under the name of American Murex Corporation, the participants in which are Murex Ltd., and the Metal & Thermit Corporation of America. The latter concern will handle products of the American Murex Corporation.

L. Mundet & Son, 461 Eighth Ave., New York City, specializing in the cork business, has changed the name of its selling organization to the Mundet Cork Corporation.

The United Engineering & Foundry Co., Pittsburgh, has received a contract for a cold rolling mill from the Otis Steel Co., Cleveland, Ohio. This contract is supplementary to one placed earlier this year involving close to $2,000,000, under which one new hot mill and the reconstruction of a second hot mill are being undertaken for the Riverside plant.

The acquisition by the Allis-Chalmers Manufacturing Co., of electrical interests of the American Brown Boveri Corporation, mentioned in *American Machinist* several weeks ago, has been approved by stockholders.

In 1924, Joseph T. Ryerson & Son, Inc., purchased the interest of W. J. Reed and others in the Reed-Smith Co., Milwaukee, Wis. Now the Ryerson Co. has purchased the remaining stock and the firm becomes the Reed-Smith plant of Joseph T. Ryerson & Son of Wisconsin, Inc.

The Dravo-Doyle Co., merchant engineer, Dravo Bldg., Pittsburgh, Pa., has been appointed exclusive representative in the Pittsburgh territory for Robbins & Myers hand and electric hoists, cranes, and trolleys by the Hoist and Crane Division of Robbins & Myers, Inc., Springfield, Ohio.

Watson Jack & Co., Ltd., 1410 Stanley St., Montreal, has been appointed sales agent for the Province of Quebec for the Dominion Hoist & Shovel Co. Ltd., Montreal.

Alexander P. Krapish will manufacture custom-built airplanes, occupying 15,000 sq.ft. of the Victory plant at Squantum, Mass.

PERSONALS

M. B. Lambert, assistant to the vice-president, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., will take over the general direction of advertising in addition to his other duties. This follows the resignation of J. C. McQuiston as general advertising manager.

Arthur Andrews has been appointed chairman of Burton, Griffiths & Co., Ltd., Montgomery St., Sparkbrook, Birmingham, England. F. W. Turrell, who is also managing director of B.S.A. who is also managing director of B. S. A. Tools Ltd., one of the firm's associated companies, takes over active control and will be assisted by E. C. Farrell, who becomes sales director.

Robert W. Ayer, formerly with the engineering department of the Granville Brothers Aircraft Corporation, Springfield, Mass., is now with the engineering department of the Stinson Aircraft Corporation, Detroit.

Frank Baackes, Jr., formerly in the Cincinnati office of American Steel & Wire Co., Cleveland, has opened an office at 1 North La Salle St., Chicago, to take charge of certain industrial and jobbing sales of the Keystone Steel & Wire Co., Peoria, Ill.

L. H. Bloom, general sales manager, Oliver Farm Equipment Co., Chicago, Ill., has resigned after 28 years in the industry. Mr. Bloom formerly was vice-president in charge of sales for Hart-Parr Co., Charles City, Iowa.

Harry L. Brindle, assistant general superintendent of the Farrell (Pa.) Works, Carnegie Steel Co., has been made general superintendent to succeed A. L. Cromlish, who has been transferred to the Duquesne works of the Carnegie company.

Daniel Wilber Coe, until recently vice-president and general sales manager of the Canadian Mead-Morrison Co., Montreal, has announced the incorporation of a new company, Canadian Hoists & Conveyors, Ltd., Montreal. Mr. Coe will be vice-president and managing director. Associated with him as directors are H. J. Lange, until recently construction superintendent of the Canadian Mead-Morrison Co., and Roy M. Beatty, until recently manager of the Canadian Mead-Morrison Co.'s plant at Welland, Ont.

W. C. Coulter, president of the Coulter Brass Co., Toronto, Ont., was elected first vice-president of the Canadian Manufacturers' Association at the annual convention in Victoria, B. C.

E. B. Cleborne, sales manager of the Wallingford Steel Co. was elected president of the Sales Managers Association of Connecticut. Other officers were named as follows: vice-president, R. W. Chamberlain, Stanley Electric Tool Co., New Britain; treasurer, G. F. Garrity, Acme Wire Co., New Haven; secretary, Charles C. Rossire, Jr., Foster Merriam Co., Meriden.

L. M. Crosby, assistant manager and purchasing agent of the Dail Steel Products Co., Lansing, Mich., has been elected vice-president of the Michigan and Indiana district, National Association of Purchasing Agents.

D. A. Currie, vice-president and general manager of the Erie (Pa.) Foundry Co., has been elected president of the Manufacturers' association of that city.

A. D. Ferguson has been made works manager of the Sullivan Machinery Co., Michigan City, Ind. He was formerly superintendent and has been succeeded by A. F. Millar. Mr. Ferguson succeeded S. T. Nelson who retired April 30 after 45 years with the company.

C. L. Ferguson has resigned as general superintendent of the Falcon works of the Empire Steel Corporation, to assume a similar post with the Mahoning Valley Steel Company. He succeeds Harry Davis, whose resignation becomes effective May 31. David Smith, hot-mill superintendent of the Falcon plant, will serve as director of operations for the Falcon units in Niles, O.

Howell Fisher, president and general manager of the Bartlett-Hayward Co., Baltimore founder and engineer, for the last three years and connected with the company for 15 years, has severed his connection effective June 1. Chester F. Hockley, formerly connected with the Bethlehem Steel Co. and the Westinghouse Co., who has been vice-president of Bartlett-Hayward for 10 years, has been elected president and general manager. Albert C. Bruce, who has been connected with the company for many years, has resigned as a vice-president.

Walter S. Gifford, president of the American Telephone & Telegraph Co., has been elected a member of the Board of Trustees of Cooper Union to succeed Thomas Snell, who died May 5.

Henry William Graves has been appointed general manager of Canadian Mead-Morrison Co., Ltd., Montreal. He became designing engineer of the Mead-Morrison Manufacturing Co. in 1926. During the past five years his services were loaned at frequent intervals to the Canadian Mead-Morrison Co. Ltd., and it was finally decided that he should be transferred to Canada as general sales manager so that he would be able to devote his entire time to Canadian design, sales and service.

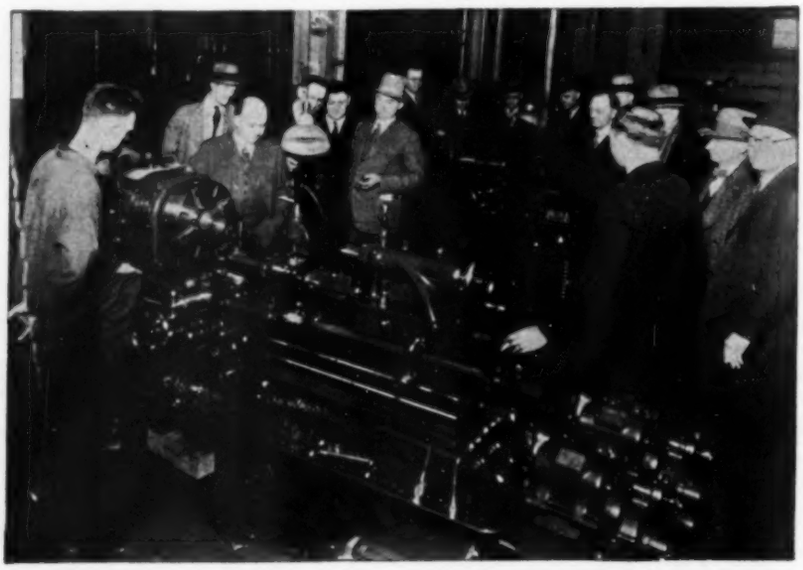
Gilbert L. Hartman, purchasing agent of the Oilgear Co., Milwaukee, has been elected president of the Milwaukee chapter, National Association of Purchasing Agents.

Archibald Hazlehurst has been appointed manager of sales of the Sterling Steel Foundry Co., Braddock, Pa. He was formerly associated with the American Steel Foundries.

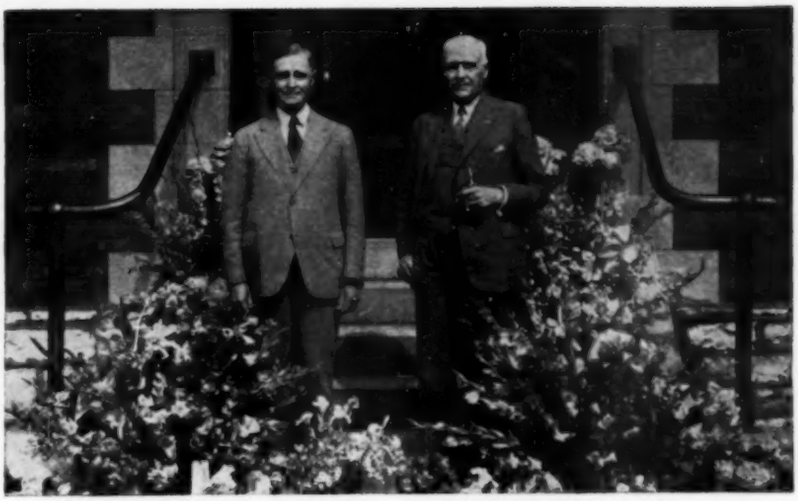
W. J. Hengehold of the Lodge & Shipley Machine Tool Co., Cincinnati, has been made secretary-treasurer of the Lunkenheimer Co., Cincinnati.

Chester F. Hockley has been appointed president and general manager of the Bartlett Hayward Co., Baltimore, to succeed Howell Fisher.

W. P. Hutchinson has been elected president of the Sprague Meter Co., Bridgeport, Conn., to succeed H. H. Sprague, president since 1900. Mr. Hutchinson has been connected with the company since 1912. Mr. Sprague was elected chairman of the board of directors, and A. I. Ayres was elected secretary-treasurer.



Visitors at the Cleveland demonstration of the Monarch-Keller form-turning machine, at the showrooms of the Strong, Carlisle & Hammond Co. This demonstration was one of a series in various sections of the country



Edwin J. Gould (left) vice-president and general superintendent in charge of operations, and Frank Low, vice-president and general sales manager, of the Ludlow-Saylor Wire Co., St., Louis, Mo., who have been with the company 50 and 40 years respectively. The company is celebrating its 75th anniversary

Norman Houston has resigned as manager of the New York office of the Alan Wood Steel Co., Conshohocken, Pa.

J. J. Kennedy has been named vice-president in charge of sales for the National Tube Co., Pittsburgh, to succeed John H. Nicholson, retired. D. H. Ramsbottom has succeeded Mr. Kennedy as general manager of sales. Homer C. Gerwig and W. F. McConnor have been made assistant general managers of sales.

H. M. Lawrence, mining engineer, and S. W. Benham, assistant engineer, have been appointed to the staff of the A.S.A. Mr. Lawrence will have supervision of all the mining, chemical, and ferrous and non-ferrous metallurgy projects, and Mr. Benham will assist in the supervision of civil engineering and transportation projects.

Charles R. McConner, Detroit manager for Carrier-York Corporation, Newark, N. J., has been appointed sales manager of the Clarage Fan Co., Kalamazoo, Mich.

L. C. McCaskill, formerly with the General Motors Acceptance Corporation, Detroit, has been appointed special representative in the southwestern territory for Aluminum Industries, Inc., Cincinnati. His headquarters will be in Kansas City, Mo.

Lyall Mitchell has been appointed district sales representative in Oregon for the Ohio Power Shovel Co. Mr. Mitchell's headquarters are in Portland with the Western Road Machinery Co.

George F. Newell has been elected vice-president and general manager of the Pyrometer Service & Supply Corporation, 1988 East 66th St., Cleveland, Ohio, a subsidiary of the Claud S. Gordon Co., Chicago, Ill. Mr. Newell was formerly St. Louis representative of the Charles Engelhard Co., and more recently Chicago representative of the same firm.

Robert McMillan, for the past 20 years purchasing agent for the Pittsburgh Steel Co., will retire July 1 and will be succeeded by Albion Bindley.

W. J. Parker has been appointed commissioner of the Forging Manufacturers' Association to succeed G. H. Weiler. Offices have been moved to 7 East 44th St., New York City.

D. J. Quammen has been appointed manager of the Philadelphia district office of Cutler-Hammer, Inc., Milwaukee, Wis., to succeed F. J. Burd, who has been made assistant manager of the Chicago office.

Charles Miller Robertson, president of James Robertson & Co., Ltd., manufacturers of plumbers' supplies, with plants in Montreal, St. John, N. B., and Winnipeg, died in Montreal on June 3. Mr. Robertson was also president of the Kingdon Mining & Smelting Co., Ltd., and of the Robertson Lead Manufacturing Co., Ltd.

Daniel M. Sachs has been elected president of the National Transit Co., Oil City, Pa., and its two subsidiaries, the National Transit Pump & Machine Co., and the Maryland Pipe Line Co. to fill the vacancy caused by the death of L. E. Lockwood.

O. E. van Altena has been appointed middle-western district sales manager of Aluminum Industries Inc., Cincinnati, with headquarters at 1925 South Wabash Ave., Chicago.

Carl Warner, assistant superintendent of the Mercer (Pa.) works of the American Sheet & Tin Plate Co., a subsidiary of the U. S. Steel Corporation, New York City, has been named resident engineer of the Canton (Ohio) Roll & Machine Co.

OBITUARIES

Albert G. Bierbach, 78, retired inventor and manufacturer, and conductor for many years of a metal-working plant with his brother, the late R. C. Bierbach, died May 30 in Milwaukee.

William A. Box, 58, president of the William A. Box Iron Works, Denver, Colo., died June 6 there. He was an inventor of electric hoists, automatic automobile lifts, and other devices.

George Buchanan, president of the Long Island Foundry Co., Long Island City, N. Y., died May 22.

Harry A. Bundy, 55, chairman of the Bundy Tubing Co., Detroit, Mich., died June 2.

Robert S. Carter, president of the Latrobe (Pa.) Tool Co. and the I. M. Carpenter Tap & Die Co., Pawtucket, R. I., died May 17.

Joseph Levick, 47, proprietor of the Republic Iron & Metal Co., Erie, Pa., died June 2 of pneumonia.

Edward W. Putnam, 35, vice-president and general manager of the Kelly Reamer Co., Cleveland, Ohio, died June 1 at Springfield, Ohio.

Edgar F. Viles, 55, for many years president of the Waltham Screw Co., Waltham, Mass., died at Concord, Mass., May 20.

Alfred T. Wagner, Detroit seller of foundry supplies, died May 26 after an automobile accident.

August R. Workman, 54, an official of the American Type Founders Co., for 26 years, and president of the Workman Roller Co., Cincinnati, Ohio, died suddenly there on June 8.

FORTHCOMING MEETINGS

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Calvin W. Rice, executive secretary, 29 West 39th St., New York. The following meetings are scheduled:

AMERICAN SOCIETY FOR TESTING MATERIALS—Annual Meeting, Stevens Hotel, Chicago, June 22-26. C. L. Warwick, 1315 Spruce St., Philadelphia.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Annual Summer Convention, June 22-26, Asheville, N. C. F. L. Hutchinson, 33 West 39th St., N. Y. C.

THE INDUSTRIAL INSTITUTE—Silver Bay on Lake George, N. Y., August 10-25. Charles R. Towson, secretary, 347 Madison Ave., New York, N. Y.

NATIONAL METAL CONGRESS AND EXPOSITION — Exposition on Commonwealth Pier, and Congress sessions at Hotel Statler, Boston, Mass., week of Sept. 21. Information from W. H. Eisenman, Secretary A.S.S.T., 7016 Euclid Ave., Cleveland, Ohio.

SOCIETY OF AUTOMOTIVE ENGINEERS —National Production meeting, Detroit, Mich., Oct. 7-8. Headquarters, 29 West 39th St., New York, N. Y.

NATIONAL SAFETY COUNCIL — 20th Annual Safety Congress, Chicago, Oct. 12-16. Details from headquarters, Civic Opera Bldg., Chicago.

SOCIETY OF AUTOMOTIVE ENGINEERS —National Transportation meeting, Washington, D. C., Nov. 10-12. Headquarters, 29 West 39th St., N. Y. C.

THE INDUSTRIAL REVIEW

Weekly progress of the machinery and machine tool business

NEW YORK

Government possibilities, both federal and municipal, held the center of an otherwise almost colorless machine tool stage last week. Up at Picatinny Arsenal, bids on several turret lathes and a screw machine were opened on Friday. The same day an inquiry for 17 engine lathes was released by the Brooklyn Navy Yard. Picatinny orders must be placed by July 1; Brooklyn bids must be in by June 23, and orders will be out by July 1. The City of New York is inquiring for three upright drills, and the Bureau of Lighthouses for a second-hand radial drill. A few single sales were consummated for replacement items, one or two prospects developed, and one large dealer had his best week for some time, but progress is still contingent upon a change in the situation of general business. Orders for the Bloomfield (N. J.) school list of some 20 tools, were sent out late last week, and as mentioned previously in *American Machinist*, were spread out thin with one or two tools to a dealer. The Schenectady school list is still unissued.

DETROIT

The customary summer lull is considerably more than a lull this year; it amounts almost to a vacation. Machinery and machine tool sales have dropped off almost to the vanishing point, and there seems little likelihood of a pick-up before August. Many automobile plants have slackened, thereby cutting off the thin trickle of tool orders. A few large companies are still maintaining heavy schedules, but they seem capable of making their old equipment serve their needs.

One ray of hope developed during the last ten days. One of the largest automobile manufacturers is planning some very substantial changes. Thus far the program is in its infancy and may not even live to maturity. There is reason to believe it will be carried forward, however, and if this is true, the machinery and tool dealers will at least have some sort of return for their summer's work.

NEW ENGLAND

There is actually little change in the machine tool situation from week to week. Dullness is very much in evidence. Orders are usually small, and inquiry volume has declined steadily. Of the latter it is noted mid-western automotive manufacturers are evincing an interest in New England built equipment involving their plans for model changes. Whether or not orders will result is just another guess.

Added reports of May totals have not added luster to a month of low levels. Business in some instances was poorer than any month of 1930. At the moment, municipal, utility, governmental and electrical manufacturing sources are the bright spots for business and are the outstanding avenues to domestic distribution of machine tools. Foreign sales hold up remarkably well. One company booked enough business from this source in the past month to assure an active summer. Cases of this nature, however, are very much the exception.

PHILADELPHIA

The sale of some woodworking machinery, together with some lathes, shapers, millers and drill presses, featured market activity during the last two weeks. Some dealers professed to see an improvement in the general tone, but this has not become manifest in any substantial orders from big purchasers, and no estimate was given by anyone as to when they expect a semblance of a revival.

Railroads and automobile manufacturers remained dormant so far as this market is concerned. Inquiries have been few and far between, and a sluggish market has been the rule.

■

POSSIBILITIES for a fall upturn in machine tools and machinery seem good. It is generally conceded that betterment of general business will mean betterment of tool sales, and work done now will result in strengthening of position when that time comes. Among the possibilities is that of major design changes reported in General Motors cars to be announced this fall. This will of course require independents to make corresponding improvements and should result in die business that will indirectly aid tool sales. Otherwise, the present situation is rather uniformly quiet, with prices holding as well as can be expected.

NEW YORK possibilities are largely governmental, including a few sales to Picatinny Arsenal and an inquiry for 17 engine lathes from the Brooklyn Navy Yard. One dealer had a better week, including a $40,000 order. Detroit is quieter than it has been. New England manufacturers are hoping for some automotive sales. Governmental and foreign sales are bolstering totals there. Philadelphia's situation is reported up a little, with sales of lathes, shapers, woodworking machinery, millers, and drills. Cleveland business is practically at a standstill, with single items and some commitments of automatic machinery from automotive sources.

CHICAGO has witnessed no change in the situation, and no further summer decline is anticipated. Milwaukee has single sales and a few inquiries, largely for small tools to small interests. Cincinnati manufacturers and dealers are holding about even, the majority of commitments being single replacement items. Buffalo dealers, on the contrary, expect June to be a rather good month, at least better than May, which was spotty and disappointing. Orders are still from small buyers for single tools.

CLEVELAND

The month of June to date has failed to blossom forth with any fertile crop of machine tool orders. The past fortnight has been a repetition of many weeks in the last three months. Business is practically at a standstill with very little in sight. Sales were limited to single and small items. New inquiries continue active but they are usually nipped in the bud by the old bug-a-boo of waiting for the upward swing in general business.

Manufacturers of automatic machinery report a rosier aspect due to purchases made by automobile interests, and it is thought that requirements in this line will soon grow larger. It is a foregone conclusion that very little can be expected during the summer months, but there is a general tendency to expect a better turn in the market during the last half of the year.

CHICAGO

The first two weeks of June have witnessed no perceptible change in machine tool market conditions, nor, from the present outlook, is there a probability of much improvement for the remainder of the month. Manufacturers' representatives and selling agents decline to express themselves regarding future developments. Discussing the question as to the likelihood of a further recession in machinery sales during July and August, usually considered the least active period of the year, one leading executive informed the writer that a recent check-up of sales made during these months for the last several years disclosed but little variation from other two-month periods, a fact that led him to conclude there would be little, if any, further decline during midsummer. No new lists from any source are said to be in sight, and important inquiries are negligible. The report in circulation that the Great Northern Railroad was compiling a sizable list of shop equipment needs, to be issued in the near future, has not been officially confirmed so far as can be learned.

MILWAUKEE

Opening days of June, following a disappointing May, have added to the dullness of the local machinery and machine tool situation. Restricted business is confined to some small sales and a few scattered inquiries, with immediate prospects anything but favorable. Large purchasers seem to have deserted the market entirely, and there is apparently no reason to look for a noticeable turn upward during the summer months. Scattered sales of small tools and single units make up present business, coming largely from general machinists and miscellaneous users. One manufacturer reports bidding on a number of high-grade machines which the government is purchasing for airports. Business from schools is said to be about normal, but the volume of this source is not sufficient to fill the big gaps. One encouraging note which indicates that business will come through in fall is that executives are reported to be doing some serious figuring on requirements preparatory to placing orders at that time.

CINCINNATI

Machine tool users appear to be up in the business stratosphere, far beyond the reach of sales executives and their men. The business graph continues to show a straight horizontal line down near the bottom of the sheet, and the fondest hope that manufacturers entertain at this time is that it will not go lower. Local selling agents are securing a small order here and there and are developing such prospects as they can as they go along. The past week's bookings consisted almost entirely of orders for single tools. Buyers were located in all sections of the country and their requirements were well diversified. Inquiries remained comparatively quiet, the major portion being for single tools and replacements. Some long-pending inquiries are developing into sales, but this is infrequent.

BUFFALO

Some dealers report orders placed during the first half of June and seem to feel that it may be a rather good month—good at least compared with May, which was spotty and disappointing. Most business still comes from small buyers, and orders are usually for single pieces of equipment. Large industries are not buying to any extent.

Much the same condition exists in the electrical field except that there seems to be less business. Not much hope of a pick-up until fall is prevalent.

BUSINESS • BAROMETER

Markets are now more responsive to good news than to bad

THEODORE H. PRICE
Editor, Commerce and Finance, New York

THE Treasury Department reports that monetary gold held in the United States reached a new record on May 31, when the total amounted to $4,795,000,000. These figures do not include the ear-marked gold bullion and foreign coin held by the Reserve Banks for their correspondents abroad.

In October, 1929, less than two years ago, the total of brokers' loans, as reported by the Reserve Bank, amounted to approximately $6,800,000,000. As a result of the liquidation in the stock market they have been declining ever since, and by June 10, 1931, they amounted to a little less than $1,500,000,000. Meantime, the call loan rate is down to 1 per cent, and time money for commercial or financial financing is in abundant supply at rates that seem to be almost ridiculous when they are compared with the 9 and 10 per cent that was being paid for banking accommodation prior to the autumn of 1929.

These are the salient facts of the fiscal position in this country. They ought to be reassuring, for an abundance of credit at low rates has nearly always been a precursor of a trade revival. Sometimes the revival has seemed to be slow in coming, but it has never failed to arrive, although its advent has been delayed in some instances by the prevalence of pessimism or an unlooked for breakdown in the world's financial machinery.

A careful study of the week's news seems to indicate that we have reached a point at which the markets are more responsive to good than to bad news despite the dire predictions of an English economist now in America. This interpretation of current developments is vindicated by the action of the markets upon the news from Chicago, where several large banking institutions have consolidated, and twenty-four small banks have suspended payment "for the protection of their depositors."

For a brief period this news caused a secondary depression in the stock market, but it did not last long, and the resiliency shown was more impressive than the slight weakness that preceded it. This was also true of the commodity markets, which are, upon the average, a little higher than they were a week ago.

In the stock market, a variety of influences have been at work. Cheap money has continued to stimulate the investment demand for good bonds, but mistrust of the situation has deterred would-be buyers of stocks, and it is only the bargain hunters who are taking advantage of the present depression. But the resistance to adverse news seems to increase day by day, and there are many indications that good securities bought now will show a substantial profit by the end of the year.

A further contraction in the steel industry is reported, but it is very slight. The automobile output is also smaller, but it is quite natural that the Chicago bank failures should have restrained those who were thinking about the purchase of a new car.

In the larger cities the department stores are advertising price reductions of from 50 to 70 per cent, and one well-known concern announced that the number of its sales during the month of May exceeded last year by 42 per cent. It is, however, made clear that this does not mean that the money value of the goods sold was 42 per cent over last year, but that this was the percentage of increase in the number of items purchased by customers. One of the big mail order concerns reports an increase of 7.7 per cent in the money value of its sales during the first week of June and the Federal Reserve Board at Washington put the value of department store sales for May at 14 per cent under the total for the same month last year. Of course, this means a substantial increase in the volume of sales, as prices have declined much more than 14 per cent during the last twelve months.

There is disposition to assume that the Interstate Commerce Commission will grant the 15 per cent advance in freight rates for which the railroads have applied. Perhaps this is taking too much for granted, but on the Stock Exchange little doubt of favorable action is entertained.

The commercial and financial news from abroad is not sensational. A better feeling seems to prevail on the London Stock Exchange, where the weakness of South American securities had caused alarm earlier in the month.

The efforts that Germany is making to obtain a reduction in her reparation payments are palpably evident, and there are many who think that the concessions asked for will have to be granted. If not it is almost certain that these payments will cause continued friction and irritation during the fifty-eight years that must yet elapse before they are completed. Partial confirmation of this view is inferred from the announcement that Prime Minister MacDonald will shortly visit Berlin.

Much unemployment is still reported in Great Britain as well as in the United States. It is, however, questionable whether the number of the idle in either country is as large as commonly supposed.

THE BUSINESS WEEK

June 17, 1931

Early June measures of business movement show a slight intensification of the oncoming summer flatness in some lines. . . . But marked and mildly encouraging irregularities are developing in the picture at a time when a fairly uniform let-down might be expected under the prevailing pessimism. . . . Steel activity continues to sag under an accentuated seasonal slump in automotive requirements, though there is nothing abnormal about the decline in output and bookings except the low level from which the changes take place. . . . Building contracts, especially residential, seem to be weakening a little, along with power production; but carloadings are holding their seasonal level and coal output is higher. . . . May department store sales did not continue to show their earlier strength. . . . The sustained high level of outstanding currency is probably not unconnected with continued weakness of confidence and local outbreaks of bank closings. . . . Nevertheless, there is something impressive about the persistent failure of our index of general business activity to break through its resistance level at this stage. . . . The same is true of stock prices and commodities. . . . The outlook for better wheat prices, in particular, is more promising. . . . European maneuvers in the direction of bringing the reparations, debt and disarmament problems to a head by tying them together are encouraging, though actual accomplishment is not imminent and the difficult diplomatic discussions involved may be disturbing.

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95 Broad St., New York

THE WEEKLY PRICE GUIDE . . . .

Rise and Fall of the Market

UNFILLED orders of the U. S. Steel Corporation, May 31, of 3,620,452 tons, are 6.8 per cent under those of Apr. 30 and 10.6 per cent below volume of May 31, 1930. The May total, however, is similar to that of 3,628,089, for the same period of 1924. Structurals, pipe and rails form the bulk of current consumption. Third-quarter prices are indefinite and it is likely that the current mill-base of $1.65 per 100 lb., Pittsburgh, will hold. Slab zinc, at E. St. Louis, is up 0.1c. per lb., to 3.3c., compared with the June 5 level. Declining trends continue in copper, both ingot and fabricated, fabricated brass and scrap non-ferrous metals.

(All prices as of June 12, 1931)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI:	
Ala. Foundry (Silicon, 1.75@2.25)	$14.19@$14.69
Tenn. Foundry (Silicon, 1.75@2.25)	14.19@ 14.69
NEW YORK:	
Buffalo No. 2 Fdry. (Silicon, 1.75@2.25)	19.91@ 20.41
BIRMINGHAM:	
No. 2 Foundry (Silicon 1.75@2.25)	12.00@13.00
PHILADELPHIA:	
Eastern Pa., No. 2x (Silicon, 2.25@2.75)	17.76
Virginia No. 2 (Silicon, 1.75@2.25)	22.29
Basic	17.00@17.25
CHICAGO:	
No. 2 Foundry, Northern (Silicon, 1.75@2.25)	17.50
No. 2 Foundry, Southern	17.01
PITTSBURGH:	
No. 2 Foundry	17.50
Basic	16.00@16.50
Bessemer	17.50

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.00
Cleveland	4.75
Cincinnati	4.40
New York	4.75
Chicago	4.50@4.75

STEEL SHEETS—Prices are in cents per lb. for sheets from warehouse stock except at Pittsburgh mill, where prices apply on large lots:

Blue Annealed*	Pittsburgh Mill	Chicago	Cleveland	New York
No. 10	1.85	3.35†	3.00	3.20‡
No. 12	1.90	3.45†	3.10	3.25‡
No. 14	2.00	3.55†	3.20	3.30‡
No. 16	2.10	3.65†	3.30	3.40‡
Black				
Nos. 18 to 20	1.95@2.05	3.60†	3.40	3.30
No. 22	2.10@2.20	3.75†	3.55	3.45
No. 24	2.15@2.25	3.80†	3.60	3.50
No. 26	2.25@2.35	3.90†	3.70	3.60
No. 28	2.40@2.50	4.05†	3.85	3.75
Galvanized				
No. 10	2.05@2.10	3.65†	3.20	3.35
Nos. 12 to 14	2.15@2.20	3.75†	3.40	3.40
No. 16	2.25@2.30	3.85†	3.50	3.50
No. 18	2.35@2.40	4.00†	3.65	3.65
No. 20	2.55@2.60	4.15†	3.80	3.80
No. 22	2.60@2.65	4.20†	3.85	3.85
No. 24	2.75@2.80	4.35†	4.00	4.00
No. 26	3.00@3.05	4.60†	4.25	4.25
No. 28	3.25@3.30	4.85†	4.50	4.50

*Light Plates. †400 to 3,999 lb. ‡1,000 to 3,999 lb., ordered and released for shipment at one time.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. butt..	56.14%	43.6%	53.3%	42.3%	57.3%	44.8%
3½ to 6 in. lap..	52.72%	40.18%	50.8%	37.8%	53.9%	41.4%

List prices on which foregoing discounts apply, are as follows:

Size, Inches	List Price per Foot	Diameter in Inches—External	Diameter in Inches—Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.275	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.585	2.875	2.469	.203
3	.765	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28
8	2.50	8.625	8.071	.277

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

Thickness		Outside Diameter in Inches						
		½	⅝	¾	⅞	1	1¼	1½
Inches	B.w.g.	Price per Foot						
.035	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049	18	.17	.18	.19	.20	.21	.23	.25
.065	16	.19	.20	.21	.22	.23	.25	.27
.083	14	.20	.22	.23	.24	.25	.27	.29
.095	13	.21	.23	.25	.26	.27	.29	.31
.109	12	.22	.24	.26	.27	.28	.30	.32
.120 or .125	11	.23	.25	.27	.28	.29	.31	.33
.134	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered bessemer rods	7.00	6.00	6.15
Hoop steel	3.55†	4.00	3.65†
Cold rolled strip steel	4.95	6.00	6.10
Floor plates	4.65†	5.00	5.00†
Cold fin., round or hexagon	3.40	3.40	3.35
Cold fin., flat or square	3.90	3.90	3.85
Structural shapes	2.90†	2.95	3.00†
Soft steel bars and bar shapes	2.90†	2.95	2.90†
Soft steel bands	3.20†	3.20	3.10†
Rivets, structural or boiler	4.00	4.00	4.00
Tank plates	2.90†	2.90	3.00†
Bar iron (2.75 at mill)	2.90	3.00	2.90†
Drill rod (from list)	65%	55%	60%

*Flat, 7/16-in. thick by ¾-in. wide. †Minimum, Chicago, 400 lb., New York, 1,000 lb., ordered and released for shipment at one time.

Electric welding wire at New York warehouse—3/32, 8.35c. per lb.; ⅛, 7.85c. per lb.; 5/32 to ½, 7.35c. per lb.

METALS

Warehouse prices in cents per lb. for small lots:

Copper, electrolytic, New York			9.50
Tin, Straits, pigs, New York			24.00
Lead, pigs, E. St. Louis	3.60	New York	4.75
Zinc, slabs, E. St. Louis	3.30	New York	4.50

	New York	Cleveland	Chicago
Antimony, slabs	9.00	10.00	10.75
Copper sheets*	18.12½	18.12½	18.12½
Copper wire*	10.00	9.62½	10.12½
Copper, drawn, round*	16.62½	16.62½	16.62½
Copper tubing*	20.62½	20.62½	20.62½
Brass sheets, high*	15.50	15.50	15.50
Brass tubing, high*	20.37½	20.37½	20.37½
Brass rods high*	13.75	13.75	13.75
Brass wire, high*	16.12½	16.12½	16.12½

*Mill, base.

SHOP MATERIALS AND SUPPLIES

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%, f.o.b.	23.30	23.30	23.30
Zinc sheets (casks)	9.00	10.50	10.50
Solder (½ and ½)	20.87½	21.50	16@18
Babbitt metal, delivered in case lots, New York, cents per lb.:			
Genuine, highest grade			42.00
Commercial genuine, intermediate grade			33.25
Anti-friction metal, general service			28.00
No. 4 babbitt, f.o.b.			9.00

NICKEL AND MONEL METAL—Prices in cents per lb., base, f.o.b. Huntington, W. Va.:

	Nickel	Monel Metal
Sheets, full finished	52.00	42.00
Sheets, cold rolled	60.00	50.00
Strip, cold rolled	55.00	45.00
Rods, hot rolled	45.00	35.00
Rods, cold drawn	50.00	40.00
Tubing, seamless	75.00	65.00
Angles, hot rolled	50.00	40.00
Plates	52.00	42.00

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars:

	New York	Cleveland	Chicago
Crucible copper	6.25	6.00	5.50@ 6.00
Copper, heavy, and wire	5.62½	5.75	4.75@ 5.25
Copper, light, and bottoms	4.62½	5.25	4.50@ 5.00
Heavy lead	2.50	2.75	2.00@ 2.50
Lead battery plates	1.12½	1.00	1.25@ 1.50
Brass, heavy, yellow	3.00	3.75	3.00@ 3.25
Brass, heavy, red	4.75	5.50	4.25@ 5.00
Brass, light	2.00	2.25	2.50@ 2.75
No. 1 rod-brass turnings	3.50	2.75	3.00@ 3.25
Zinc	1.00	1.00	1.00

TIN PLATES—Charcoal—Bright—Per box:

"AAA" Grade:	New York	Cleveland	Chicago
IC, 14x20	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.07@$0.11	$0.13	$0.13
Cotton waste, colored, per lb.	.05½@.09	.09	.09
Wiping cloths, colored, per lb.	.10	.08	.09
Sal soda, per lb.	.01¾	.02	.02
Roll sulphur, per lb.	.028	.03	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.	.092	.099	.096
Cutting oil, about 25% lard, per gal	.65	.60	.60
Machine oil, medium-bodied, per gal	.33	.28	.21
Belting—Discounts from list:			
Leather—List price, 24c. per lin.ft., per inch of width, for single ply:			
Medium grade	30-10%	30-10%	50%
Med. grade, heavy wgt	30%	30 -5%	40%
Rubber transmission—List price, 6-in., 6 ply, $1.83 per lin.ft.:			
First grade	60-10-10%	50-10%	60%
Second grade	70-10%	60- 5%	65%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.029	$0.029	$0.0325
Cold fin. shafting	per lb.	.034	.034	.034
Brass rods	per lb.	.1375	.1537½	.18
Solder (½ and ½)	per lb.	.2087½	.2087½	.2525
Cotton waste, white	per lb.	.07@.11	.07@.11	.13
Disks, aluminum oxide mineral, cloth, No. 1 6-in. dia	per 100	4.36	4.59	4.59
Lard cutting oil	per gal.	.65	.75	.65
Machine oil	per gal.	.33	.35	.33
Belting, leather, medium	off list	30-10%	30-10%	30-10%
Machine bolts, up to 1x30 in., full kegs	off list	65%	65%	50-10%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper*	$6.03	$6.03	$6.03
Emery cloth*	20.31	25.87	25.87
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper†	2.61	2.61	2.61
Cloth†	4.36	4.59	4.59
Fire clay, per 100 lb. bag	1.00	.75	.75
Coke, prompt furnace, per net ton		Connellsville,	2.40
Coke, prompt foundry, per net ton		Connellsville,	3.25
White lead, dry	100 lb. kegs	New York,	13.25
White lead, in oil	100 lb. kegs	New York,	13.25
Red lead, dry	100 lb. kegs	New York,	13.25
Red lead, in oil	100 lb. kegs	New York,	14.75

*Less than 3 reams. †Less than 200.

SHOP SUPPLIES

Discounts from list, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less	65%
Larger, up to 1 x 30-in., full kegs, list less	65%
Less than full kegs or case lots, add to list	10%
Fitting-up bolts: list less	45%
Lag screws:	
Up to ½-in. x 6-in., list less	65%
Larger, list less	65%
Less than full keg or case lots, add to list	10%
Rivets:	
Structural, round head, full kegs, net	$4.00
Structural, round head, broken kegs, net	4.50
Tank, 7/16-in. dia. and smaller, list less	65%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less	65%
Larger, up to 3-in., list less	65%
Less than keg or case lots, add to list	10%
Washers:	
Wrought, full kegs, per 100 lb., list less	$4.00
Wrought, broken kegs, per 100 lb., list less	2.00
Turnbuckles:	
With stub ends, list less	20-10%
Without stub ends, list less	55%
Chain:	
Proof coil, base, per 100 lb., net	$9.50
Cast iron welding flux, per lb., net	.35
Bronzing flux, per lb., net	.50

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Equipment Wanted

Mass., Boston—Old Colony Furniture Co., 560 Harrison Ave.—single surface planer, 30 in., motorized ball bearing type.

Mass., Hamliton—Town, J. Lamson, Chn., Bldg. Comn.—woodworking, metalworking and print shop equipment, also press drills, lathes, etc., for proposed 2 story, 120 x 125 ft. school.

Mass., Waltham (Boston P. O.)—O. N. W., 25 Palmer St.—36 in. brake and 36 in. shear.

Ont., Acton—Ontario Memorial Co., Kilvington Bros. (mfrs. tombstones, memorials, etc.)—interested in prices on electric crane, etc., for plant.

Opportunities for Future Business

Indiana — National Auto Haven Co., 201 North Wells St., Chicago, Ill., will receive bids until June 20, for the construction of a group of service stations, each 85 x 88 ft. at West Lafayette, Warsaw, Valparaiso, Tremont, Kentland, Goshen, Columbia City and Angola. Estimated total cost $400,000. Private plans.

Ind., Anderson—Guide Lamp Co., will build a 2 story, 40 x 100 ft. factory at West 25th St. Estimated cost $40,000. Private plans. Work will be done by separate contracts.

Ind., Terre Haute—Highland Iron & Steel Co., 28th St. and Fourth Ave., branch of American Chain & Steel Co., 400 West Madison Ave., Chicago, Ill., plans the construction of a new unit to plant here. J. Schlossberg, plant manager.

Me., West Peru—Berst-Foster-Dixfield Co., F. W. Smith, Mgr., manufacturers of wood products, is having preliminary plans prepared for a factory. Estimated cost $50,000. H. F. Hallock, Oswego, N. Y., Archt.

Mass., Brighton (Boston P. O.)—International Harvester Co. of America, 606 South Michigan Ave., Chicago, Ill., will soon award contract for a 1 story, 85 x 195 ft. storage building; also addition to service station at Everett and Beacon Sts. here. Estimated cost $50,000. Private plans.

Mass., Edgartown—G. L. Marchant, Robinson St., awarded contract for the construction of a 2 story garage and storehouse on Robinson St. Estimated cost $40,000.

Mass., Hamilton — Town, J. Lamson, Chn. Bldg. Comn., is having plans prepared for the construction of a 2 story, 120 x 125 ft. high school on Union St. Estimated cost $150,000. C. B. Loring, 7 Water St., Boston, Archt.

Mass., Hyde Park (Boston P. O.) — Royal Curtain Mfg. Co., 35 Kingston St., Boston, is taking preliminary estimates for alterations to factory on Hyde Park Ave. here. Estimated cost $40,000. Private plans.

Mass., Lowell—Whitehead Corp., 44 School St., Boston, awarded contract for the construction of a 1 and 2 story, 75 x 235 ft. garage on Howe St. Estimated cost $75,000. Private plans.

Mass., Springfield—City, C. J. Morrow, Chn. Bldg. Comn., is receiving bids for the construction of a 3 story technical high school on Elliot St. Estimated cost $400,000. F. W. S. King, and E. C. and G. C. Gardner, 33 Lyman St., Archts.

Mass., Taunton—Taunton Pearl Works, 35 Vernon St., will soon award contract for remodeling 2 story manufacturing plant on Ingell St. Estimated cost $50,000. Jackson & Moreland, 31 St. James Ave., Boston, Archts. Noted June 4.

N. H., Milford—Souhegan Motor Co., c/o A. W. Osberg, 795 Elm St., Manchester, Archt., is receiving bids for addition and alterations to garage, 2 story, 50 x 105 ft. here. Estimated cost $40,000.

N. J., East Orange—William Gudzenhauser, c/o N. Harris, 17 Merchant St., Archt., awarded contract for the construction of a 1 story, 100 x 110 ft. garage on Spring St. Estimated cost $150,000.

N. J., Jersey City—J. Goldenberg, 80 Woodland Ave., Englewood, postponed construction of a 15 story garage here. $500,000. C. Shilowitz, 26 Journal Sq., Archt. Maturity probably in Sept. Noted May 7.

N. J., Maplewood—Kroydon Co., Burnet Ave., is receiving bids for a 1 story addition to factory for the manufacture of golf clubs. Estimated cost $40,000. D. A. Hopper, 22 Ridgewood Ave., Irvington, Archt.

N. J., Newark—Bd. of Commissioners, City Hall, is having plans prepared for the construction of a 1 story, 100 x 140 ft. manufacturing plant at Port Newark. Estimated cost $40,000. Architect withheld. Reliable Box & Lumber Co., 65 Ave. A., lessee.

N. J., Newark—J. C. Kohaut, Inc., 117 Green St., awarded contract for the construction of a 3 story, 50 x 100 ft. woodworking factory on New York Ave. Estimated cost $40,000. Noted June 11.

N. Y., Brooklyn—H. S. Burnham, 215 West 75th St., New York, plans the construction of a 100 x 160 ft. garage and storage building at Gravesend Ave. and Ave. J here. Estimated cost $40,000. W. Shary, 22 East 17th St., New York, Archt.

N. Y., Brooklyn—R. Arons, 1669 45th St., plans the construction of a 100 x 100 ft. service garage, and gas station at 17th Ave. and 62nd St. Estimated cost $40,000. Kallich & Weinstein, 375 Fulton St., Archts. Maturity about October. Noted June 4.

N. Y., Brooklyn — P. S. Glickman, 1498 Broadway, is having sketches made for the construction of a 100 x 200 ft. service garage at 23rd Ave. and 59th St. Estimated cost to exceed $45,000. H. J. Nurick, 44 Court St., Archt.

N. Y., Brooklyn—M. S. Kaplow, 3114 Ave. M., plans the construction of a 2 story service garage at West 4th St. and Ave. P. Estimated cost $40,000. I. Kallich, 375 Fulton St., Archt. Maturity late fall. Noted June 4.

N. Y., Brooklyn—National Saw Dust Co., 69 North 6th St., is receiving bids for the construction of a 2 story, 25 x 100 ft. factory at North 6th St. and East Kent Ave. Estimated cost $40,000. Laspai & Samenfeld, 217 Havemeyer St., Archts. Noted June 4.

N. Y., Brooklyn—New York Dock Co., 44 Whitehall St., New York, plans alterations to manufacturing and storage buildings at various locations here. Estimated cost $40,000. L. E. Driver, 334 Furman Ave., Archt. Work will be done by day labor and separate contracts.

N. Y., Brooklyn—Thames Trading Co., L. Hirsch, 47 Thames St., plans the construction of a 4 story, 100 x 200 ft. plant at Bogart St. and Harrison Pl. Estimated cost $250,000. S. Goldswith, 4914 Church Ave., Archt.

N. Y., Brooklyn—Morris Tucker, 120 Magnolia Ave., Floral Park, is having preliminary plans prepared the construction of a 90 x 150 ft. service garage at Crystal St. and Liberty Ave. here. Estimated cost $40,000. M. Hirsch, 350 Stone St., Archt.

N. Y., Buffalo—A. F. Oliver Gear & Machine Co. Inc., 60 Cherry St., plans the construction of a 1 story, 85 x 250 ft. factory at Niagara Sq. and Albany St. Green & Son & Hopkins, 1 Niagara Sq., Archts.

N. Y., Jamaica—P. Fantino, 169-19 107th Ave., is having sketches made for the construction of a 1 story, 87 x 116 ft. service garage at Merrick Rd. and 107th Ave. Estimated cost $40,000. E. Guterman, c/o owner, Archt.

N. Y., Long Island City—Dept. of Water, Gas & Electricity, Municipal Bldg., New York, awarded contract for a 2 story, 52 x 150 ft. shop, etc., at Dryer and Packard Sts. here. $43,000. Noted April 16.

N. Y., Maspeth—Circle Flexible Conduit Co., 24-44 Woodward Ave., is having preliminary plans prepared for the construction of a 1 story, 94 x 100 ft. factory at Woodward and Flushing Aves. Estimated cost $40,000 including equipment. S. Goldsmith, 4914 Church Ave., Brooklyn, Archt.

N. Y., Mitchel Field—Construction Division, War Dept., plans the construction of a post exchange building and machine shop, also assembly shop and air corps warehouse at Salfridge Field, Mich.

N. Y., New York—Star Co., 220 South St., will award contract about July 1 for the construction of a 3 story warehouse and factory building at 419 Water St. Estimated cost $175,000. Lockwood, Greene Engineers Inc., 100 East 42nd St., Archts. and Engrs. Noted April 2.

O., Cleveland—Juvenile Courts Building Commission, J. H. Harris, Chn., Court House, will receive bids until July 2 for the construction of a juvenile detention home, 3 story, 40 x 230 ft. court buildings, department buildings, 30 x 165 ft. service building, etc., at East 22nd St. and Central Ave. Estimated cost $1,650,000. F. W. Bail Co., Hanna Bldg., Archt.

O., Cleveland—J. B. Perkins, c/o H. K. Ferguson Co., Hanna Bldg., Contr., awarded contract for a 1 and 2 story, 155 x 220 ft. assembly plant and 46 x 155 ft. office at 6400 Herman Ave. Estimated cost $200,000.

O., Toledo—Port Toledo Inc., D. Yoder, Pres., is having plans prepared for the construction of a 7 story, 60 x 180 ft. garage at Madison and Summit Sts. Estimated cost $500,000. Mills, Rhines, Bellman & Hordhoff, Ohio Bank Bldg., Archts.

Pa., Erie—General Electric Co., O. D. Young, Pres., River Rd., Schenectady, N. Y., plans the construction of a 2 story, 40 x 70 ft. factory and office, also taking bids for a 1 story, 315 x 440 ft. warehouse on East Lake Rd., here. Estimated cost $40,000.

R. I., Gloucester—Dept. State Police, New Industrial Trust Bldg., Providence, plans the construction of a 1 and 2 story garage and police barracks here. Estimated cost $50,000. Architect not selected.

R. I., Providence—Paragon Worsted Co., A. Milot, 1937 Westminster St., awarded contract for a 3 story, 50 x 90 ft. addition to textile plant. Estimated cost $50,000.

R. I., Richmond—Dept. of State Police, New Industrial Trust Bldg., Providence, is receiving bids for a 1 and 2 story garage and police barracks. Estimated cost $50,000. Jackson, Robertson & Adams, 1216 Turks Head Bldg., Providence, Archts. Noted May 14.

Tex., Brownsville—J. R. Box, San Angelo, plans the construction of a 1 story planing mill here. Architect not selected.

Tex., Tyler — Gulf States Telephone Co., is having preliminary plans prepared for the construction of a 6 story, 50 x 100 ft. equipment building and office. Estimated cost $150,000. E. A. Noland & Son, Tyler, Archts.

Va., Fredericksburg — Collins Flashlight Corp. of Virginia, C. B. Collins, Takoma Park, Md., Pres., recently organized with capital stock of $1,000,000 plans establishment of a new plant to manufacture batteryless flashlight here.

Ont., Windsor—Viking Automatic Sprinklers Ltd., plans the construction of a plant. Estimated cost $25,000.

Ont., Toronto — Continental Carbon Inc., 13900 Lorain Ave., Cleveland, O., manufacturers of radio resisters and carbon specialties, plans the construction of a plant here.

Que., Montreal—Modern Light Aircraft Co. Ltd., G. F. Gregory, Pres., plans the construction of a plant for the manufacture of airplanes, etc. to include equipment.

Que., Montreal—Rockbestos Products Corp., 285 Nicoll St., New Haven, Conn., plans the construction of a plant for the manufacture of electric equipment here.